THE DETERMINANTS OF COMPETITIVE ADVANTAGE: A CRITICAL APPRAISAL

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A Thesis Submitted for the Degree of PhD
at the
University of St. Andrews

1991

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A CRITICAL APPRAISAL

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Ph.D. Economics
University of St. Andrews
August 1990

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THE DETERMINANTS OF COMPETITIVE ADVANTAGE :

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ABSTRACT

The thesis deals with the means whereby a firm can gain a competitive advantage over its rivals. After considering how this issue is dealt with in the management literature, the thesis focuses on two possible routes to competitive advantage. The first is largely internal to the firm, and concerns the design of managerial contracts to provide managers with the incentives to act in the best interests of shareholders. The second route is external, involving strategic market moves in relation to rival firms. These two possible routes to competitive advantage are appraised in light of recent theoretical developments in principal-agent analysis - the internal route, and the new industrial economics - the external route. The final section of the thesis is empirical and deals with the share price experience of the top 100 U.K. companies since 1970. The econometric notion of cointegration is employed to test for the existence of sustained competitive advantage. The tentative conclusion reached is that while companies may be able to achieve a sustained competitive advantage, the compensation contracts employed have not been a successful means of obtaining such advantage. The suggestion is that external routes to competitive advantage might be more effective.

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PART I - INTRODUCTION

CHAPTER 1

AN OVERVIEW

This thesis examines the concept of competitive advantage and its determinants. It provides a review of the literature as well as an empirical investigation into the ability of firms to sustain a competitive advantage. The issue of competitive advantage is complex and requires a structured framework from which to gain meaningful insights into such questions such as : Why is one firm more successful than another firm?, and how can a firm consistently earn super-normal profits over time?
The thesis is divided into five parts:

PART I

Part I, the introduction, contains a review of the more important work dealing with Competitive Advantage in the business strategy literature. Chapter 2 discusses primarily the work of Porter, arguably the best known writer on the subject. His investigation of the determinants of competitive advantage relies on the concept of a "value chain", the complete set of activities undertaken by a firm to produce and sell its outputs. He maintains that competitive advantage can be gained by applying one, and only one of the following three generic strategies : cost leadership, differentiation, and focus. After critical evaluation of this proposition it is concluded that, although the business strategy literature can provide useful insights for managers seeking competitive advantage, it falls well short of providing an all-embracing formula for gaining competitive advantage.

PART II

Part II of the thesis presents an outline of the theory of the principal and agent. The background is set in Chapter 3 where an attempt is made to move away from the traditional neo-classical analysis of the firm, which treats the firm as a "Black Box", an agency existing solely to organise the production process to achieve certain objectives. The ideas of Coase, who sees the firm as an institutional response to market failure, are taken as the point of departure. It is suggested that the work of Coase and others could hold a clue as to how firms might generate and sustain a competitive advantage: the presence of bounded rationality, opportunistic behaviour and asset specificity opens up the possibility that the market is no longer the best governance mechanism. The obvious alternative of government by management requires arrangements involving more than price - quantity - quality stipulations.

The formal analysis of optimal contracts between Principals and Agents is discussed in Chapter 4. The aim of agency theory is to provide a characterisation of the optimal contract, ie. the contract which maximises the utility of the principal while ensuring that the agent achieves the reservation level of utility. This is an important area of analysis, since a common area of application is one in which company shareholders (principals) delegate decision making responsibility to a senior executive (agent). The problem then becomes one of designing an optimal contract that will induce the executive to exert the effort required to align his or her objectives with those of the shareholders, given various states of the world.

Having discussed Principal-Agent theory, Chapter 5 examines how compensation contracts have been designed in practice. A central issue in this chapter is whether in reality compensation plans have been designed to induce effort or avoid tax. Given that Principal - Agent analysis suggests that the optimal contract is likely to be extremely complex, it seem reasonable to assume that firms will forego strict optimality in the interests of practicality. This raises the question as to whether companies really do address the problem of providing executives with appropriate incentives. An examination of the most commonly employed compensation schemes and their incentive properties suggests that it is extremely difficult to disentangle incentive and tax considerations.

Chapter 6 provides a survey of studies of the empirical relationship between executive compensation and performance. Taken at face value the studies suggest a positive and significant relationship between pay and performance. However, there are difficulties with interpreting the results, specifically with regard to the issue of causality and the cross - sectional nature of the studies. The available empirical evidence does not provide conclusive answers to the question of whether compensation packages provide the appropriate managerial incentives for greater effort, and thus generate an improvement in corporate performance; or whether causality works in the opposite direction, improvements in corporate performance arising from reasons independent of managerial effort, with opportunistic managers exploiting the opportunities for higher compensation levels.

PART III

Part III of the thesis investigates the external aspects, such as market strategy, whereby a firm might achieve a competitive advantage. The way in which the external environment affects the competitiveness of a business has been the chief concern of Structure - Conduct - Performance (SCP) models. These are discussed in Chapter 7. The SCP approach attempts to establish causal links between market conditions, and the adoption of different strategies which may allow a firm to gain a competitive advantage in the market place. However, the SCP paradigm is unable to provide a clear and unambiguous theoretical foundation for the investigation of firm - industry relationships. Some sort of positive association between concentration, barriers to entry and performance emerges from most empirical studies, but it is by no means clear that the relationship reflects the causal process specified in the SCP paradigm. Furthermore, the paradigm is ambivalent on whether the structure variables which affect performance are part of some "state of nature" over which firms have little or no control, or whether structure is susceptible to manipulation by firms.

The scope for such manipulative or strategic moves is the subject of Chapter 8. The discussion highlights the point that in markets which satisfy the conditions for contestability, there is little scope for strategic moves. In practice, however, few if any markets meet the strict requirements of contestability: the implication is that there is considerable scope for strategic moves designed to gain a competitive edge over rivals.

The major emphasis of Chapter 9 is on the nature of strategic choices. For a strategic move to be successful it must influence other firms' expected payoffs from the various courses of action open to them. One way is for the strategic move to influence, in a lasting way, cost or demand conditions. Investment in capacity, R&D and advertising are the main strategic weapons considered. Strategic use of expenditure on these items is possible because of the nature of the associated costs - they are, at least to a degree, "sunk" costs, and hence require an irreversible commitment by the firms that use them. Various possible commitments by the firms are considered and it is concluded that the scope for strategic use of these weapons is a function of the nature of market competition (whether it is price sensitive) and the nature of the investments themselves (whether they project an aggressive or non - aggressive image).

The second way for a strategic move to succeed is for it to influence the beliefs of those whose behaviour it is designed to affect, even if it does not influence actual cost and demand conditions. With asymmetric information between market participants, the less informed firms will make inferences from the behaviour of more informed rivals. This theme is examined with reference to the vexed question of predatory pricing. The conclusion to emerge is that because in a world of uncertainty, it is appearance rather than reality is what counts, firms may well engage in predatory practices to gain a reputation for toughness. This is designed to influence the beliefs of other firms in the market, and those who might contemplate entry.

PART IV

The discussion in Parts II and III of this thesis suggests that it might be illuminating to try new methods of testing for possible internal and external routes to competitive advantage. This is the concern of Part IV. Cross - Section methods have not been conspicuously successful in casting light on the issues involved, so it is useful to consider what could be achieved by time series methods.

The major point of departure here is the use of time series cointegration techniques to test for the existence of the equilibrium relationships suggested earlier in the thesis. In particular, two questions are posed :

Is there any tendency for a company's share price to converge onto an equilibrium relationship with that of the industry within which it operates or with that of the market as a whole?

Is there any tendency for executive compensation to converge onto an equilibrium relationship with the share price of the parent firm?

The cointegration technique is explained in Chapter 10. The approach has its roots in two bodies of literature : the statistical literature on testing for unit roots and stationarity in time series; and the econometric literature on distinguishing actual from spurious relationships between variables.

The relationship between the firm's share price and that of the industry or market is the subject of Chapter 11. The existence of cointegration between these variables might be seen as constituting prima facie evidence that there is no scope for sustained competitive advantage. Cointegration tests on the top 100 U.K. companies by market capitalisation between 1970 and 1987, however, suggest that cointegration relationships do not exist, the implication being that there do exist opportunities to sustain competitive advantage.

Chapter 12 investigates the ability of firms to sustain a competitive advantage through the use of compensation contracts. Unfortunately, a shortage of observations, due to executive compensation only having been reported annually over the past nine years, renders the results reported in this chapter at best tentative. The motivation for conducting these tests, however, was more one of demonstrating a method which could be less tentatively employed when or should more data become available. The existence of a cointegration relationship between executive compensation and parent company share price would suggest that a stable, non - spurious relationship between the two variables does exist. The tests, however, provide tentative evidence to the contrary. Of course, the tests say nothing about the optimality of the compensation contracts, but the implication is that while companies may be able to achieve a sustained competitive advantage, the compensation contracts employed have not been a successful means of obtaining such an advantage. The suggestion is that external routes to competitive advantage might be more effective.

CHAPTER 2

THE CONCEPT OF COMPETITIVE ADVANTAGE

2.1 THE ANALYSIS OF COMPETITIVE ADVANTAGE IN THE BUSINESS STRATEGY LITERATURE

It is primarily the writers on business strategy who popularised the concept of competitive advantage. This is hardly surprising given the audience these writers address. Both practising and prospective managers will be expected to listen attentively to advice on how to improve corporate performance, particularly if this advice is coined in an idiom to which they are accustomed.

The aim of this section is to characterise and evaluate the type of analysis employed in the literature. Arguably, the topic of competitive advantage as viewed by business strategists received a most systematic and at the same time methodologically representative treatment in the work of Michael E. Porter (1980 and 1985). A large proportion of this section, therefore, will be devoted to the examination of his ideas. In addition, a small but roughly representative sample of the other contributions to the topic will be surveyed briefly.

Competitive advantage essentially amounts to achievement of supernormal profits which can be viewed as rent. They can be sought through a variety of avenues. A major part of Porter's effort is directed to producing a classification of these avenues which would be both exhaustive and illuminating for businessmen. In Competitive Strategy (1980, p.XIX-XX, p.40-41, p.64-67) we find lengthy lists, with many sub-headings, of points to consider when formulating the competitive strategy, organisational arrangements and skills required for different ways of achieving competitive advantage, and factors to be taken into account when analysing the strength of a competitor. The last list contains sixty-four factors grouped under eighteen different sub-headings. In a similar manner Porter (1980, p.3-33) investigates the effect on profitability of, what he terms, the five competitive forces. These are : bargaining powers of buyers and sellers, threats posed by potential entrants and substitute products, and rivalry amongst the incumbents. A large part of the 1980 book outlines how the relative importance of the factors affecting profitability varies between emerging, mature and declining industries and then between what are termed fragmented and global industries.

In the 1985 book Porter simplifies his classification schemes by introducing the concept of a value chain. This concept refers to a complete set of activities undertaken by a firm to produce and market its output. All primary activities are said to fall into one of the five classes :

inbound logistics, operations, outbound logistics, marketing and sales, and services. Similarly all support activities fall into one of the four classes : procurement, technology development, human resource management, and firm infrastructure. The last class includes such activities as general management planning, finance, accounting and legal work. Porter (1985, p.39) claims that when searching for the avenues leading to competitive advantage it is much more productive to analyse the value chain rather than value added. According to Porter, the value added analysis "incorrectly distinguishes" between raw materials and other purchased inputs into a firm's activities. It is not conducive to a simultaneous examination of the cost behaviour of activities and the cost of inputs required to carry them out. Porter also asserts that value added analysis "fails to highlight" the potential linkages between a firm and its suppliers that can raise profitability.

From the perspective of this thesis it is not imperative to establish how superior, if at all, the value chain analysis is to other techniques of surveying the totality of a firm's activities. To be useful, all these techniques must be flexible enough to accommodate highly diverse circumstances under which firms operate. It should be apparent that what is crucial in a businessman's search for competitive advantage is not a division of primary and support activities into respectively five and four broad classes. His success is much more dependent on how perceptive and innovative he will be in sub-dividing these broad activities into narrower categories and finding his way through a complex set of interrelationships between them. Such a set, in most cases, is highly specific for individual firms.

The question arises as to how useful can this advice on the best way of constructing a detailed value chain be. Not all types of knowledge can be fully articulated. Frequently, to remain relevant for decision-taking, knowledge must be conveyed quickly. However, the cost of accelerating the process of articulation may be so high as to be prohibitive. Some knowledge is necessarily, as Polanyi (1967) calls it, tacit. It can be argued that the analytical skills of a manager in pinpointing crucial interrelationships between activities of the firm he manages are based on knowledge which is essentially tacit. Clearly his skills can improve as a result of learning by doing. Management education involving an in depth discussion of numerous case studies has a potential to be useful. However, if we accept that managers in their problem solving rely on tacit knowledge, then an insightful presentation of a case study must be based on research carried out by an outsider. Are there many such outsiders who can gain access to the relevant information?

The point at issue can be elucidated further by considering the knowledge of an athlete and his coach about ingredients of the athlete's successful performance. It is the coach rather than the athlete who usually finds it opportune to articulate this knowledge. Given their close working relationship the information at his disposal is extensive . Will those who are able to observe at close quarters a successful businessman in action have an incentive to articulate and then publicise what allowed him to reconfigure the value chain of his firm?

Tacitness of economic agents' knowledge has often been recognised by economists. A particularly apt and succinct formulation can be found in the 1946 article by Fritz Machlup : "The business man who equates marginal net revenue productivity and marginal factor cost when he decides how many to employ need not engage in higher mathematics, geometry, or clairvoyance. Ordinarily he would not even consult with his accountant or efficiency expert in order to arrive at his decision; he would not make any tests or formal calculations; he would simply rely on his sense or his "feel" of the situation. There is nothing very exact about this sort of estimate. On the basis of hundreds of previous experiences of a similar nature the businessman would "just know", in a vague and rough way, whether or not it would pay him to hire more men". (1946, p.355).

The principle Machlup is referring to (to maximise profits equate marginal net revenue productivity to factor cost) is much more specific than the principle enunciated by Porter (to gain competitive advantage think in terms of nine broad classes of activity and then subdivide them further taking into account the circumstances under which your firm operates). It would therefore appear that if successful businessmen can apply the first principle without being conscious about it the application of the second principle in the same fashion would present even less of a difficulty.

Porter (1980, p.34-46 and 1985, p.11-26) also proposes a complementary formula for gaining competitive advantage. The formula is very concise : given the three generic strategies - cost leadership, differentiation and focus - choose one, and not more than one, of them. The cost leadership allows the firm to earn a higher rate of return than its competitors. A successful differentiation leads to monopolistic profits. It is well known that the dynamic process outlined by Chamberlin erodes these profits. Consequently to maintain competitive advantage, differentiation must be continuous. The focus strategy involves pursuing either cost leadership or differentiation in a segment of the market.

The argument rationalizing the formula can be found in Caves (1984). The choice of one strategy presupposes an adoption of an appropriate organisational framework and incentive system. An advantageous environment thus created for the pursuit of one strategy must necessarily be less advantageous for the pursuit of another. An attempt to create two different environments for different parts of a business unit is likely to be frustrated in view of a limited coordinating capacity of its managerial personnel. Caves maintains that " a firm's managerial cadre may hope to beat its median-ability competitor along one dimension, but not along every dimension" (1984, p.127).

The validity of the view that strategy choices are exclusive can perhaps be established by a carefully conceived empirical research. This is, however, not to be found in Porter's published work. Instead, he offers a wealth of essentially anecdotal evidence. According to Porter (1980, p43) a striking example of a firm that achieved success via differentiation strategy is provided by Mercedes. Referring to this example, Karhani (1984, p.377-378) raises several points which undermine Porter's formula. They can be paraphrased as follows: Why is it Mercedes rather than Rolls-Royce that achieved success through differentiation? Could it be that the high profitability of Mercedes is due to high differentiation of its products relative to its cost position? If so then what is crucial for gaining competitive advantage is not the pursuit of a single strategy but rather an appropriate combination of activities directed both at securing a low cost position and differentiation. In many industries one strategy is likely to bring higher returns or can be more easily executed than the other. If an industry is characterised by increasing returns to scale then a firm's low cost position, regardless of scale, will facilitate its expansion. In this way the benefits obtainable from the cost leadership strategy will be magnified. Low cross-elasticities between outputs of the firms in an industry will make differentiation an unattractive option.

Porter emphasises that the successful implementation of a differentiation strategy depends on controlling unit costs of output (1985, p.127-130, p.161). The question arises, however, as to whether this control will be effective enough under a unidimensional strategic thrust. If not then Porter's formula must be re-drafted to read : for each strategic option equate the marginal benefit and the marginal cost of its articulation and implementation. The relevant cost should include the opportunity cost of a reduction in time which the managers devote to the pursuit of other strategic options. Once the formula is clothed in the marginalist garb it is easier to realise the difficulties inherent in its application.

Porter's analysis of competitive advantage extends to various aspects of rivalry between incumbent firms and between incumbents and entrants. He strongly advocates achieving accommodation with "good competitors" and taking steps to arrive at the optimal competitor configuration (1985, p.201-228). Good competitors can help in adjusting to fluctuations in demand and, by serving as a standard of comparison, facilitate differentiation. They can supply the less attractive segments of a market where, for instance, a strong bargaining power of buyers forces the price/cost margin down. By serving these segments they make it more difficult for an entrant attempting to gain access to the more profitable segments of the market to establish a bridgehead. The presence of a less profitable competitor can moderate the wage claims made by trade unions with membership covering the whole industry. An advantageous competitive configuration can result in a degree of standardisation of technology which signals to the buyers that the industry's products are unlikely to become outdated in the near future. More generally, it can lead to sharing the costs of market development.

According to Porter, "a good competitor, while seeking to earn attractive profits, is typically satisfied with its current returns and knows that improving them is not feasible" (1985, p.215). Is Porter not asking too much of him? It can be argued along the lines of Simon (1959) that firms stop searching for improvements in their performance as soon as a "satisfactory" result is achieved. On those grounds an aggressive stance towards good competitors should be avoided : once their position is gravely undermined they may embrace strategies which reduce profitability of the whole industry. The argument that firms satisfice rather than maximise, however, sits uneasily alongside the presumption that they aim to gain competitive advantage.

It is noted that to sustain competitive advantage a firm needs to forgo some of its short term profit (Porter 1985, p.482). This, in most cases, involves making an investment to defend its present market position. Chapter 14 of the 1985 book (p.482-512) outlines three categories of possible defensive moves. Those falling under the first category raise structural barriers to entry. With a high level of advertising in an industry, a challenger whose scale of output will be lower than that of the industry's leader, will face the prospect of higher unit costs. The same prospect can be created by a high spending on R&D to raise the rate of product innovation in the industry. Providing dealers and buyers with finance on favourable terms will raise the minimum capital requirements for competing with the incumbent. The second category of moves increases expected retaliation. For example, excess capacity signals ability to wage a price war. Signing a host of long-term supply contracts for large quantities of inputs signals a determination to maintain the present market share. Finally, the incumbent can aim to lower the inducement for entry. To achieve this, highly ambitious profit targets should be avoided or an effort should be made to communicate to potential competitors a realistic assessment of the industry's future profitability.

It can be seen that once again Porter offers a relatively comprehensive classification of factors behind an important aspect of competitive advantage. However the classification as such does not substantially help an individual firm to decide what combination of the defense moves is optimal. Such a combination is likely to vary greatly depending on the circumstances under which a firm operates. A contrast can be drawn between Porter's approach to defense strategy and that found in closed-loop models of rivalry to be discussed in chapter 9 of this thesis. The models aim to determine the optimal sequence of moves to be chosen from a specified small set. They also aim to identify what constitutes a credible commitment on the part of an incumbent to defend his position. Porter's aim is to draw a comprehensive list of defensive moves in an ordered form and then to indicate which of them are preferable under certain broad conditions. As can be expected he is left with a number of loose ends in his analysis. It is hard to see how they can be tied without imposing the type of restrictions specified in the simplified assumptions of the closed-loop models.

An analysis similar to Porter's analysis of defensive moves is presented by MacMillan (1983). What is stressed in this article is the importance of seizing strategic initiative for gaining competitive advantage. Seizing initiative amounts to forcing the competitors to take a reactive rather than proactive role. This apparently can be achieved on the basis of a thorough understanding of entry and exit barriers, factors which determine how fast the competitors respond to a strategic move (inertia barriers), intelligence systems, the nature of pre-emptive moves, a wider market environment required to make a product profitable, opportunity costs of strategic decisions, factors determining what business units in the firm's portfolio ought to contract or expand, and finally the background situation which allows firms to identify the prime targets of the strategic move. (MacMillan 1983, p. 43-49).

This already formidable list is further extended by Schuler and MacMillan (1984) to include human resource management practices. Their understanding should lead to appropriate selection and motivation of employees. Schuler and MacMillan claim that companies achieve success largely by effective use of their human resources. To establish this claim they consider it sufficient to point to individual personnel management practices applied in some successful companies. Thus, for instance, it is stated that Lincoln Electric, a leader in small motors and arc welders, has a compensation system strongly tied to the company's profits; The American Productivity Center in Houston hires consultants who are the generalists and promotes a multi-disciplinary approach to consulting engagements;

I.B.M. and Procter & Gamble carefully screen their job applicants and then programme the assignments for new employees with the aim to socialize them into the corporate culture; Delco-Remy, a supplier of car batteries to Honda, trains its employees in participative management (Schuler and MacMillan 1984, p.244-251).

To evaluate the above approach the following question needs to be asked. Is the statement that a large number of firm's activities are crucial for gaining competitive advantage much different from the one asserting that it is the totality of activities which is important? Perhaps the difference would be more pronounced if the first statement was modified to read : There is a small number of specific activities which are not crucial for gaining competitive advantage. Moreover, the authors in question rely excessively on exemplification to support the argument.

Gluck, Kaufman and Walleck (1980) maintain that competitive advantage is gained if strategic planning is linked in a thorough way to operational decision making. In their view, to accomplish this it is necessary to adopt a planning framework that cuts across divisional boundaries, encourages entrepreneurial thinking and modifies a corporate value system to generate full commitment of managers to the firm's strategy (1980, p.158-161). Gluck et al see this type of planning as a progression from its more rudimentary types. The line of progression is traced to run from basic financial planning to forecast-based planning, where the length of the time horizon is extended and more sophisticated tools of forecasting employed, and then to externally oriented planning, where different scenarios are examined and attempts are made to shift companies activities to the most profitable segments of the emerging markets. To support their contention that competitive advantage is gained by closely linking strategic planning and operational decision making, Gluck et al rely on the evidence they collected during a two year study of 120 large companies.

Inevitably questions arise about the quality of the evidence which can be obtained from the study. How accurately can the commitment of managers to the firm's strategy be measured? How can the organisational arrangements which promote entrepreneurial thinking be weighted against those which discourage it? Would it be appropriate to form an idea about the extent of integration between strategic planning and operational decision making on the basis of the extent to which strategic objectives were achieved? Would it not be difficult to avoid considering some indicator of a successful firm's performance as a direct manifestation of entrepreneurial thinking? Given these questions it appears that the evidence Gluck et al are referring to can only be of a suggestive nature.

Yet another perspective on the sources of competitive advantage to be found in the business strategy literature locates them in the superior quality of assets that some firms happen to have at their disposal. Implicitly it is assumed that other firms can only employ personnel and capital of lower quality. The basic flaw inherent in the perspective is pointed out by Caves (1984, p.131). To establish that sustained competitive advantage is due to superior assets employed by the firm it is necessary to explain why these assets do not command rents on account of their differential productivity or attract offers of higher remuneration from other firms. Apparently the writers on business strategy do not address these issues.

In conclusion it can be said that the business strategy literature presents a number of classifications of firms' activities that could produce valuable insights for a manager who searches for competitive advantage. It does not, however, present him with much more than that. A bold attempt by Porter to establish that superior performance is achieved by pursuing exclusively one of the three generic strategies cannot be judged to be successful. The exclusive pursuit of cost leadership or differentiation or one of both in a segment of the market could make limited sense only if the cost and differentiation were highly discrete variables. Only then could a profit-maximising firm find itself in the situation where the marginal products of its resources devoted to cost reduction and differentiation were not the same. A firm can be seen as pursuing, say, cost leadership strategy if marginal product of resources employed to this end is lower than those employed to other ends. In general, however, it cannot be assumed that over the time horizon typically considered by corporate strategists costs are reduced and differentiation reinforced in highly discrete steps.

2.2 COMPETITIVE ADVANTAGE AND MICROECONOMIC THEORY

It is natural to ask what contribution have the theories of the firm and market rivalry, as developed by the mainstream economists, made to our understanding of competitive advantage. The static theory of the firm puts forth two conditions for profit maximisation : marginal cost must equal marginal revenue and marginal cost of factor inputs must be equal to their marginal revenue product. It follows that firms where the two conditions are met have a competitive advantage over firms where they are not.

Meeting the conditions for profit maximisation requires, first of all, calculation of marginal figures. The standard accounting information is in the form of total and average rather then marginal figures. However it is possible to derive from standard accounts approximate marginal values of the key variables. Falling average cost over a certain period of time indicates that it is above marginal cost.

Changes in total revenue allow us to estimate marginal revenue. Separate accounts for different plants makes it easy to find the values for the broad margin of the variables. On the other hand it is clear that more exact marginal figures are costly to produce. A complex parallel system of accounts may be required for this purpose. To calculate marginal products of individual inputs when their quantities change simultaneously requires careful analysis of time series data. Better marginal figures should lead to an increase in profit, but the cost of obtaining them may easily exceed the amount of this increase.

Extending marginal accounting from a static to a dynamic framework is a difficult task. Consider, for instance, uncertainty regarding future values of the cost variables. To predict broad changes in average cost the knowledge of new technological developments and future prices of inputs may be sufficient. To form an idea about the magnitude of the marginal cost changes, the knowledge of the above normally needs to be supplemented by an informed guess about the future state of demand. By their very nature marginal concepts are better suited for an analysis of small rather than large changes.

It can therefore be argued that the performance of a firm may not be much affected by the presence or absence of its formal commitment to equalizing marginal cost and marginal revenue over some lengthy time horizon. It is rather the quality of its predictions regarding the environment in which it will operate in the future that counts. Given scanty information about the future, the problem is much more how best to use this information to generate forecasts of marginal revenue and costs rather than how to adjust productive capacity to equate the two.

Mainstream microeconomic theory has always been subject to criticism on account of its assumption that economic agents optimise. For this criticism to be constructive it must be demonstrated that some alternative theorising, where the assumption of optimisation is discarded, is capable of generating hypotheses which can withstand repeated empirical testing. A blueprint for such a theorising under the name of evolutionary theory was drafted by Nelson and Winter (1982). It so happens that this blueprint provides us with a new perspective on competitive advantage. It will therefore be useful to outline the main steps in Nelson and Winter's argument.

They view the firm as an organisation where the activities of employees are highly routinised. The specific forms of the routines which are followed have emerged in an evolutionary manner over the lifetime of the organisation. These forms are difficult to change because they represent a truce between groups of employees with conflicting interests : it is always costly in terms of time and resources to arrive at a new truce in a complex organisation.

Paradoxically, even innovation activities are highly routinised. They are undertaken when problems arise in accomplishing the standard tasks allocated to individual divisions within the firm or when the signs appear that the firm's position in the market place is undermined. Usually a specialised personnel is employed to produce remedies for a crisis situation. Nelson and Winter argue that the reliance is on well established routines in searching for the remedies. They acknowledge that they, in effect, adopt the Schumpeterian view that in the capitalist economies the innovation process has gradually become more and more institutionalised. It is also noted that frequently an innovation consists of forming a new combination of the components of well tried routines.

Given the above, the Nelson and Winter assertion that "...highly flexible adaption to change is not likely to characterise the behaviour of individual firms" (1982, p.135) is fully justified. It further follows that firms can perform excellently in terms of profitability when their specific routines suit well the environment in which they operate. The firms will perform well for long periods if the environment remains unchanged : their routines will normally take a long time to be replicated by competitors. It is not so much the production technology as the pattern of interrelationships between employees which is difficult to replicate. To achieve the second more fundamental restructuring of individual employees' skills is usually required. Consequently Nelson and Winter's theorising leads to the view that competitive advantage is essentially a matter of luck. The credence of this view will depend on the degree of corroboration which the evolutionary models will obtain from the industry level empirical data.

Over the last two decades the optimisation models of mainstream microeconomics have increasingly allowed for imperfection of information and pervasiveness of moral hazard. It can be expected that their results will be of more direct use to businessmen than those of the models which assume away the uncertainty. The new optimisation models focus primarily on the relationship between principals and agents and market rivalry. A firm can offer its executives contracts that reduce the possibility of shirking and adverse selection. Considerable benefits can also be gained from analysing potential moves and countermoves of the competitors in an explicitly optimising framework. Clearly the new models explore two particular avenues for gaining competitive advantage.

In modelling the relationship between principals (shareholders) and agents (executives), economists assume that both maximise their utility and that the former are free to select employment contracts for the later. Much has been learned about the nature of the optimal contract in a single period framework. However, if the principal and agent theory is to produce specific prescriptions about the form of managerial incentive schemes that will secure competitive advantage for the firm, more work needs to be done on its extension in two directions. First, a fuller characterisation of the optimal contract in the multi-period framework needs to be obtained. Second, the question of suitability of alternative incentive schemes for firms and industries operating under different conditions should be addressed in a more comprehensive manner.

To analyse market rivalry economists employ non-cooperative game theory. Their more sophisticated models of rivalry are set firmly in a dynamic framework where the selection of particular moves during a game reveals valuable information to the other players. However, these models are unlikely to produce a complete characterisation of the optimal sequence of moves against the rivals. Essentially this is due to the fact that the optimal play should take advantage of the mistakes made by the opponents (Binmore 1987, p205-206). Some degree of arbitrariness is inevitable in modelling these mistakes. Consequently the economists employ a variety of alternative equilibrium notions in their models of rivalry. Nevertheless, it can be expected that empirical testing of these models will eventually allow us to form an idea about the appropriateness of different sets of assumptions for modelling rivalry in particular industries.

The discussion of approaches to competitive advantage in the business strategy literature and that implicit in the theory of the firm under certainty established that both strands of literature suffer from serious limitations. It is the contention of this thesis that Principal-Agent theory and the non-cooperative game theory of market rivalry are capable of offering prescriptions for achieving competitive advantage which would be of a more specific nature. Consequently the main body of the thesis will discuss the major developments within these theories.

PART II : INTERNAL ASPECTS : CONTRACTUAL RELATIONSHIPS

CHAPTER 3

MARKETS VERSUS NON-MARKET GOVERNANCE

3.1 INTRODUCTION

In the primitive stages of economic development, production can be carried out by individuals working for themselves with tools fashioned by themselves for the task at hand. The case of the stone-age hunter springs to mind. Indeed, even in "developed" nations, some goods and services are still produced much in this way. The writing of a book, or the giving of a haircut are two examples, but even here, the capital equipment (pens and scissors) will usually be produced by other individuals. The fact is that the overwhelming majority of today's goods and services are produced by groups of cooperating individuals in conditions far removed from those of our stone-age hunter.

Why do such groups of cooperating individuals exist in a market economy, and what is the precise nature of the cooperative behaviour of these groups of individuals? To some extent, this question was ignored in conventional neoclassical analysis of the firm - the firm was conceived of purely as a "black-box"; an agency assumed to exist to organize the production process to achieve certain objectives. Why it existed, or what motives there might be to set up such an institution was first formally analysed by Coase (1937). According to Coase, the firm is a particular institutional response to market failure.

This basic insight will form the basis for the discussion in section I, where it is argued that the insights of Coase, together with those of other economists who have developed his level of thinking (notably Alchian and Demsetz (1972) and Williamson (1975)), give a vital clue to the question of how modern firms might be able to sustain a competitive advantage over their rivals: the firm is an institutional response to market failure; this response reduces transactions costs; might it not be the case that particular institutional arrangements and contracts among employees will be more efficient than others?

A formal answer to this question will be attempted in section 4. The framework used is that of Principal-Agent analysis, a framework which seems to be particularly suited to the analysis of the problem of designing optimal production arrangements within the firm. This is so primarily because, in stark contrast to the conventional theory of the firm, the firm is no longer purely a "black-box". As will be seen, the Principal-Agent analysis can get to grips with the important issues of the internal organisation of economic activity within the firm, focusing on such important issues as the divorce of ownership and control, the hierarchical structure of employees and imperfect and incomplete information. Under such conditions it is possible to define "optimal" contracts between agents under certain circumstances; unfortunately such contracts are liable to be extremely complex, imperfect instruments for their stated objectives, and particularly sensitive to the economic environment. Thus while in principle the route to competitive advantage via devising optimal contracts within the firm seems attractive, this chapter concludes, pessimistically perhaps, that the scope for such contractual arrangements in today's business conditions is, arguably, limited.

3.2 INSIDE THE BLACK BOX

Coase (1937) may be credited as the founder of the modern theory of the firm. As opposed to the "black-box" firm of conventional neoclassical theory, he focused on the more important structural characteristics of modern business enterprise, the most important of which include:

(1). the ownership structure: a firm may be owned either individually or collectively, with each owner liable for the debts of the firm to the full extent of his wealth. Alternatively, the firm may be owned by either a few or many people or indeed other organisations with the liability of each limited only to the value of his ownership shares, which may be exchangeable on a stock market.

(2). the control structure: where the firm is owned by one individual, or small group of people, overall control will most probably be exercised by someone with a considerable ownership share. However, where ownership is widely dispersed, control is exercised by a "board of directors", comprising of senior executives and other outside directors acting as agents of the owners. (This delegation of choice from owners to employees will play a crucial part in the subsequent analysis).

(3). the organisational structure: a hierarchical structure will exist between those who carry out basic productive activities, and those monitoring productive performance. This structure is intended to fulfil various objectives including the translation of broad policy objectives formulated at the executive level into specific plans, to coordinate the separate activities at lower levels, to monitor performance, and to transmit information back to senior executives which will become an input into future policy objectives.

The basic approach which Coase adopted was to question why such complex institutional arrangements exist for the production of goods and services. His answer relies, at least in part, on a simple observation. In a free competitive economy a firm can exist only if it performs some function that market prices, and the process of competition cannot. Coase observed that as well as benefits, there were costs involved in using the price system to allocate resources in an economy. The benefits include, of course, the flow of information among agents and sectors of the economy; the costs however are often non-trivial. The major costs involved in effecting transactions via the market mechanism are those of acquiring information about prices and the terms of trade; the costs associated with negotiating and concluding contracts; and the uncertainty which may exist about the conditions of markets in the future. In some cases, these costs may be minor, in others they could greatly exceed the costs of organising production within a firm, in which case Coase would predict the latter to dominate.

In essence then, Coase views the firm as a particular institutional response to "market failure" at the most micro level of the economy. Thus the firm is "an island of conscious power" embedded in an external system of market forces which condition in part its operations. Coase's work offers a persuasive conceptual foundation for most of the recent work in the theory of the firm.

The work of those who have built upon Coase's theory may be grouped into two broad categories: contributions of authors who focus on the costs inherent in the price system, deriving insights about the failure of markets (see for example Arrow and Hahn, 1971); and contributions of authors who have directed their analysis to the specific benefits to the firm. It is the latter contributions which are important to an understanding of the optimal contract issue; amongst the more important contributions are Alchian and Demsetz (1972) and Williamson (1972; 1979).

Williamson's analysis builds directly on the insights of Coase. The analysis proceeds as follows: (1) markets and firms are alternative instruments for completing a related set of transactions; (2) whether a set of transactions ought to be executed across markets or within a firm depends on the relative efficiency of each mode; (3) the costs of writing and executing complex contracts across a market vary on the one hand with the characteristics of the human decision makers involved with the transaction, and with the objective properties of the market on the other; and (4) although the human and environmental factors that impede exchanges between firms (across a market) manifest themselves somewhat differently within the firm, the same set of factors apply to both.

In brief, in Williamson's account, market failure, and the consequent replacement of the market by the firm results from a particular configuration of human and environmental factors in a given market setting. The most important environmental factors include the degree of uncertainty, and the number of decision makers. The most important human characteristics, according to Williamson, are those associated with "bounded rationality", or the inability of humans to undertake complex calculations in the world as we know (or do not know) it. Thus, for Williamson, the important point is to investigate the characteristics of organisations that tend to ameliorate the consequence of bounded rationality in the presence of uncertainty or complexity. The extent to which this is possible will be the theme of section 2 in this chapter.

Before that, however, it is worthwhile considering the contribution of Alchian and Demsetz to our understanding of the modern business organisation. Their point of departure is the above account of why firms exist: Alchian and Demsetz offer a persuasive account of why the predominant kind of firm is the so-called "entrepreneurial firm" as opposed to other species such as the workers' cooperatives. Their answer is as follows: Production is usefully viewed as a team effort. The essence of team production is that several types of resource are used, the product is not the sum of the separable outputs of the competing resources, and not all resources are contributed by one person. This immediately leads to a problem. When the producing group works as a team, there is the obvious problem of measuring and rewarding each member's effort in such a way as to reward high productivity and penalize shirking. The problem is like the "free-rider" problem in public sector economics. In the absence of a proper system of rewards and punishments, it is in an individual's self-interest to minimize his contribution to the team output, since the costs of doing so, in terms of reduced output, are spread over the whole team. Conversely, the rewards of increased effort will not accrue to the individual but will be spread over his team-mates. All kinds of problems can arise in such cases. For example, a new member of a team may misrepresent his abilities and ask for higher rewards than his productivity warrants, and then account for his poor performance by blaming his team-mates. Alchian and Demsetz argue that an efficient escape from this impasse involves the appointment of a monitor to apportion rewards. However, to give the monitor the proper incentive to perform this task, a claim to the residual income (or profit) accruing to team performance must be set aside for the monitor. Thus, the monitor would be responsible for his own self discipline. In the "classical" entrepreneurial firm the monitor is the entrepreneur himself. He makes contracts with the team members and has the right to terminate them. He is the residual claimant of the surplus of the firm after all team members, and other creditors have been paid. In the modern entrepreneurial firm, however, the monitoring role is delegated, at least in part, by shareholders to senior executives. This leads directly to a hierarchical structure within the firm. Shareholders have the problem of trying to give executives the correct incentives to maximize the residual income accruing to production, while executives themselves may well need to devise means of encouraging high productivity at the lower level of the organisation if their own fate is linked in any way to the overall performance of the company.

Let us consolidate the argument thus far. The conventional "black-box" approach to the firm, prevalent in undergraduate economic textbooks, whilst arguably useful for certain purposes, fails to come to grips with many important aspects of the modern business organisation. The firm is, in fact, a complex institutional response induced by market failure at the micro-micro level of the economy. It has been argued that a system of command (ie. the firm) may well be able to perform certain tasks more efficiently than the market mechanism. To achieve this requires that the firm can ameliorate some of the problems associated with the operation of markets under certain conditions. These problems largely relate to uncertainty and the attendant costs of gathering information, and concern also the strategic interaction between individuals. In practice, the firm attempts to ease some of these problems by a system of contracts between the various individuals comprising the organisation. The question naturally arises as to whether there might be a well - defined "optimal" set of contracts between individuals and the firm, and, if so, whether a firm might sustain a competitive advantage over its rivals by implementing these contracts.

3.3 WILLIAMSON AND THE TRANSACTIONS COST APPROACH

Oliver Williamson's magnum opus, The Economic Institutions of Capitalism (1985), provides a useful point of departure for discussion of what is usually known as the "transactions cost" approach to explaining non-market forms of economic organisation. Traditional neoclassical theory deals with market forms of economic organisation, and ".... is distinguished by two features : first, no one relies on someone else for directions about what to do; market price alone directs production and exchange .... second, production results from cooperative teamwork or cooperative production leaving no role for contracts or any other constraints (such as rigid prices) on the options of cooperating parties .... yet in a wide array of economic activities people rely on and follow the administrative directions of other people, and both explicit and implicit agreements restrict options .... in other words "firms" or organised and managed "coalitions" exist. Why?" (Alchian and Woodward, 1988, p.66) The general answer to this question offered by Williamson is that ".... the economic institutions of capitalism have the main purpose and effect of economising on transactions costs ...." (Williamson 1985, p.17)

Williamson's more specific answer to the question outlines two sets of conditions under which market mechanisms will not solve production and allocation problems efficiently. The first set is made up of the well known sufficient conditions for market failure : in the presence of externalities, and in particular the free rider problem, the market mechanism will not solve the production and allocation problem, as in the case of public goods, for example. The second set constitutes Williamson's distinctive contribution to the analysis of circumstances in which the market mechanism will not work, or at least not work efficiently, and is made up of three necessary conditions which taken together, in the absence of externalities, make it likely that a marriage of the market mechanism and contractual relationships will not generate efficient solutions to the production and allocation problems. The three joint requirements for Williamson's transaction cost analysis to be relevant are : <u>asset specificity</u>, in the sense of inanimate or human capital not being perfectly transferable from one activity to another; <u>bounded rationality</u>, in the form of limits to information available to individuals, or limits to their powers of calculation; and <u>opportunism</u>, implying that individuals are not merely pursuing their self interest but are willing to profit at the expense of others.

3.4 BOUNDED RATIONALITY, OPPORTUNISM AND ASSET SPECIFICITY

Williamson illustrates why all the three requirements for market-cum-contract mechanism failure need to hold simultaneously by considering what happens when only two of the requirements are present. The following table, extracted from Williamson (1985, p.31), illustrates four possible cases.

TABLE 3.1

Attributes of the Contracting Process

Case	Bounded Rationality	Opportunism	Asset Specificity	Implied Process
I	No	Yes	Yes	Planning
II	Yes	No	Yes	Promise
III	Yes	Yes	No	Competition
IV	Yes	Yes	Yes	Governance

In Case I assets are specific, individuals are opportunistic but blessed with unbounded rationality. Planning contracts, as discussed in the mechanism design literature (e.g. Harris and Townsend 1981), can in this case deal efficiently with the production and allocation problem. The presence of opportunism requires that contracts respect private information, to deal with the incentive alignment problem, but all relevant contractual issues are settled ex ante. This comprehensive contract allows for appropriate changes to be made in response to any possible set of publicly observable contingencies, the changes in question taking account of the degree of asset specificity. Thus the presence of unbounded rationality permits a contingent contractual means of dealing with the presence of opportunistic behaviour and asset specificity.

In Case II opportunistic behaviour is absent, so individuals honour commitments ".... the agent is as good as his bond...." (Williamson, p.31), and asset specificity is present. Given that agents fulfil their promises, an arrangement whereby individuals promise to fulfil the terms of the contract efficiently, maximise joint profits and seek only "fair" individual rewards will exclude strategic behaviour. Thus the transactions based on specific human and non-human assets can proceed on the basis of self-enforcing promises.

In Case III individuals are opportunistic and subject to bounded rationality, but assets are not specific to particular activities. Here, although individuals are not "as good as their bonds", and a complete set of ex ante contingent contracts is ruled out, contracts can be formulated and re-formulated at discrete intervals, the full contestability of the market (the terminology here is due to Baumol, Panzer and Willig, 1982) permitting entry or franchise bidding to deal with monopoly power, with contract fraud being subject to legal action, at least in principle.

Finally, in Case IV the simultaneous presence of bounded rationality, opportunism and asset specificity rules out an efficient market-cum-contract distribution problem. The ability to plan for contingent future events is absent due to the boundedness of rationality; promises are not necessarily adhered to in the presence of opportunistic behaviour; and the degree of asset specificity makes an important difference in that the absence of contestability implies the pairings of asset owners in transactions will affect the efficiency of the outcome in a manner that cannot be dealt with by recourse to legal process in contract enforcement. "This is the world within which transaction cost economics is concerned .... the organisational imperative that emerges in such circumstances is .... organise transactions so as to economise on bounded rationality while simultaneously safeguarding them against the hazards of opportunism - such a statement supports a different and larger conception of the economic problem than does the imperative "maximise profits!"" (Williamson 1985, p.32)

3.5 NON-MARKET GOVERNANCE

The presence of bounded rationality, opportunistic behaviour and asset specificity implies that market-cum-contract mechanisms will not be efficient, so opening up the distinct possibility that non-market forms of governance may be more efficient : ".... the market, with all its warts and blemishes, may still turn out to be the best governance mechanism but this is no longer certain and is certainly not universally true .... in such conditions alternative governance mechanisms must be considered and may often prove preferable" (Baumol 1986, p.280). The obvious alternatives involve government by management, whereby the market mechanism is avoided by management direction in the form of hierarchical control, decentralised control in which divisions are granted a degree of autonomy, or some combination thereof; and heterodox contractual arrangements which involve more than price-quantity-quality stipulations, examples of which may be found in supervision arrangements by franchisers, resale price controls, free maintenance deals and a wide variety of implicit or explicit agreements which lie outside the remit of the market mechanism.

3.6 MANAGEMENT COMPENSATION CONTRACTS

In relation to management compensation contracts, the market mechanism works through what Williamson terms "high-power incentives" : executives, as decision takers, would reap the benefit from "correct" decisions as if they owned the assets of the company, and conversely would bear the losses arising from "incorrect" decisions. In the presence of bounded rationality on the part of shareholders and executives, and opportunistic behaviour by the two groups, contestability could ensure that a set of conditions re-negotiated at discrete time intervals would be efficient only if the physical assets of the firm, and the human capital of the executives, were not specific to the particular set of activities pursued by the firm (Case III above). In the presence of asset specificity and bounded rationality, "high-powered incentive" compensation contracts could be efficient only in the absence of opportunistic behaviour by managers or shareholders (Case II above). Asset specificity and opportunistic behaviour would not rule out efficiency in compensation contracts provided that unbounded rationality on the part of executives and shareholders permitted the formulation of an ex ante compensation contract which could deal with all possible future contingencies (Case I above). If asset specificity, boundedness in rationality and opportunistic behaviour are likely to be present jointly (Case IV above), the clear implication to be drawn from Williamson's analytical framework is that compensation contracts between shareholders and executives which attempt to ape the market mechanism (as is the case within the neoclassical treatment of principal-agent contracts to be discussed in the next chapter) cannot be efficient.

Williamson's work does not yield any clear guidelines as to how non-market forms of governing shareholder-executive transactions may be devised to generate more efficient outcomes than "high-powered incentive" contracts. There are, however, several insights. A key problem is one of organising transactions so that executives will be motivated to acquire sufficient specific human capital, and apply this expertise without slacking, without exposing the shareholder to the problems arising from managerial opportunism, and without making infeasible demands on the information processing or calculating powers of both parties. The suggestion made by Williamson in his "hostage" model involves contractual devices which are self-enforcing. In this context the hostage could be a "golden parachute" payment to the executive in the event of premature dismissal. The standard difficulty here is that an opportunistic executive, given a sufficiently golden parachute, could arrange for the firm to be taken over by a buyer who will dismiss the previous management group. Williamson offers a solution to this problem : ".... the solution, which may work in some cases, (involves) the parable of the ugly princess .... a king who has two daughters, one beautiful, one ugly, whom he loves equally, should offer the ugly princess when a hostage is required .... for she will then serve as an effective guarantee that her father will meet his commitments, but, at the same time, the king's enemies who hold her hostage will not be tempted to keep her" (Baumol 1986, p.282).

3.7 SOME DIFFICULTIES

A major difficulty with Williamson's analysis is the lack of operational framework for formal analysis and deduction. The analytical framework yields many insights, is capable of illuminating many aspects of economic organisation neglected by neoclassical analyses of the market-cum-contract mechanism, yields testable hypotheses, and has proved useful in case studies.

Economists in, or close to, the mainstream of neoclassical analysis have suggested that Williamson's contribution could be encompassed in the mainstream by generalising the neoclassical concepts of production cost functions to include governance expenses a la Williamson : ".... perhaps the most promising (avenue) .... may be a cost function in which both types of costs are explicitly included, with efficiency requiring minimisation of the sum of the production and governance costs incurred in supplying any given volume of outputs...." (Baumol 1986, p.285).

On the other hand economists who see neoclassical economics as having led the profession down a blind alley, yielding little or no institutional content, tend to see the deficiencies of transactions cost economics a la Williamson as deriving from the market bias of the approach. Kay (1987) argues that ".... the contracting basis of transaction costs economics leads to an emphasis on markets, external and internal, ... (which) leads to a negative or distortion of hierarchy and its effects .... in fact, markets are very rare and occasional devices, most resource allocation being decided under condition of autonomy or fiat .... it is disappointing that much of the analysis so far has argued that opening the Russian doll of internal markets only reveals the Russian doll of internal markets .... the analysis of decision-taking also goes by default, efficiency considerations being presumed to win out without sufficient analysis of how this will be achieved" (Kay 1987, pp.43-45). Kay argues that transaction costs economics could avoid the "trap" of being encompassed within the neoclassical framework by focussing on " firstly .... the firm as a combination of resources rather than as an aggregation of products .... secondly, processes of decision making should be explicitly incorporated .... and thirdly, the role of hierarchy, organisation and structure should be developed in the analysis" (Kay 1987, pp.45-46).

CHAPTER 4

PRINCIPAL-AGENT THEORY AND OPTIMAL CONTRACTS

4.1. INTRODUCTION

Situations in which one individual (the agent), in return for certain rewards, is given the authority to take decisions on behalf of another individual (the principal), abound in economics. The specific context in which many features of the principal-agent problem were first explored was in the economic analysis of insurance: if an individual takes out full insurance coverage, under which he will be paid the full amount of the loss if the accident occurs, he loses the incentive to take (costly) action to reduce the probability of the accident occurring. This is the phenomenon known as moral hazard. Lately the basic model has been directed to many areas in economics and applies to any situation which has the following structure : the agent chooses from a number of alternative actions; the choice determines an outcome in conjunction with the state of the world revealed at the time; this outcome yields utility to the principal, who must reward the agent for his services. The main purpose of principal-agent theory is to characterise the optimal form of this payment under various assumptions regarding the information available to the principal.

A case of particular interest is one in which the shareholders of a firm delegate decision-taking responsibility to a senior executive. The problem fundamental to the design of an appropriate principal-agent contract is one of providing the right incentives for the executive when the shareholder cannot observe the action taken. This incentive problem raises the issue of the attainability of Pareto efficient contracts. The message that emerges from the principal-agent literature is that optimal contracts are likely to be highly complex. An obvious problem here is that actual contracts tend to be characterised by simple linear reward functions, which pay executives a fixed salary plus some fixed share of realised profits. There is no particularly good reason in the principal-agent literature, however, to expect optimal contracts to be linear. It is plausible to suggest that real world incentive mechanisms have to depart from strict optimality to be practicable.

Much of agency literature analyses the principal-agent problem in the context of a single principal, single agent, one period model. The principal and agent have strategies which are not binding, and engage in little or no communication before their "game", so the basic structure of the analysis can be seen as that of a non-cooperative game. Section II outlines this approach following the exposition of Rees (1985). Section III discusses the extension of this analysis to the realistic case of a multi-period game. ~~Section IV assesses the optimality of different types of incentive contract in light of the insights gained from the principal agent literature.~~

4.2 THE BASIC MODEL

The shareholder of the firm has a utility function, $U(\pi - Y)$ which depends on the profit of the company (π) net of the payment (Y) made to the executive for services rendered. This utility function satisfies the standard assumptions which ensure that every outcome (completeness) can be put into one indifference set (reflexivity) and no more than one indifference set (transitivity). This means that the shareholder can rank all outcomes, these preferences being represented by the utility function. To ensure mathematical tractability we take the case of non-satiation, so avoiding inequality constraints requiring Kuhn-Tucker conditions, and take the indifference set to be continuous and strictly convex. It is assumed that $U'>0$, so that an increase in income always improves shareholder well-being, and that $U''\leq 0$, which rules out risk-attracted behaviour. The shareholder derives utility only from income received.

The executive has a utility function with similar properties, $V(Y,e)$ which depends positively on the payment received (Y) so that $V_Y > 0$ and negatively on the amount of effort (e) that must be expended $V_e<0$. The utility function has the further properties that $V_{YY}\leq 0$, so that once again we rule out risk-attracted behaviour and $V_{ee}>0$, so that utility falls at an increasing rate the more effort the executive expends.

The profit $\pi(e,S)$ accruing to the firm depends on the effort expended by the executive (e) and on the revealed state of the world (S). If it were not for the presence of uncertainty the principal-agent problem would be trivial, because although the shareholder may not be able to observe directly the level of managerial effort, he would be able to infer the level of effort from the amount of profit forthcoming. Note that π_e is the marginal product of effort, which is assumed to be non-negative $\pi_e \geq 0$, allowing for some stage at which extra effort would cease to increase profits. It is also assumed that $\pi_{ee}\leq 0$. For convenience we specify $\pi_s>0$: higher values of S, represent more favourable states of the world. Without loss of generality, we assume that the set of states of the world is contained within the interval [0,1]. A substantive assumption is that shareholders and the executives have the same beliefs concerning the likelihood of each state of the world, which can be specified by a probability density function f(S). This is a rather restrictive assumption. In reality we might expect the executive to be better informed than the shareholder concerning the probability of each state of the world. This will be the subject matter of a later part of this chapter, in which the basic model is extended to allow for the situation in which the executive has superior information. At this stage we limit ourselves to the case in which the executive makes his decision concerning the level of effort to supply before the state of the world is revealed and has the same probability beliefs concerning the state of the world as the shareholder.

The central problem for the shareholder is to choose an appropriate payment schedule for the executive which depends only on variables observable to both parties. If the shareholder could observe the level of effort of the executive, the executive could be forced to supply a specified level of effort in return for the optimal risk-sharing payment. A potential source of conflict arises, however, when the shareholder cannot observe the amount of effort expended by the executive: the shareholder only cares about effort insofar as it affects the level of profit received, whereas effort yields direct disutility to the executive. If the shareholder cannot observe effort, then he has no direct means of inducing the executive to supply the required amount; given the disutility associated with effort, the executive requires an inducement to supply a level of effort appropriate to maximising shareholder utility.

The resolution of the principal-agent dilemma entails optimal risk-sharing, and providing executives with incentives to supply the level of effort at which their expected monetary reward for the marginal unit of effort loses the principal the same amount of utility as he gains from the consequent increase in the expected profit. We will deal with these two aspects in turn.

(i) OPTIMAL RISK - SHARING

The issue of risk - sharing can be isolated from the incentive problem by assuming that effort and/or the state of the world can be directly and costlessly observed, and that e is arbitrarily set at $e=e^{o}$, so that the fee schedule (Y) depends only on the state of the world (S).

The shareholder's optimisation problem is then to choose the risk-sharing payment $Y^{*}(S)$ which maximises his expected utility subject to the constraint that the executive reaches some minimum level of utility. This reservation utility constraint may be alternatively labelled the "participation constraint". The fee schedule is constrained by competition for the senior agents, who have alternative uses for their time. Thus, the contract offered to the executive must entail for him at least as much utility as he could attain in alternative employment.

Formally stated, the problem is:

$$\text{Max} \int_{s=0}^{s=1} U\,[\pi(e^{o},S) - Y(S)]f(S)ds \quad \text{with respect to } Y(S)$$

$$\text{subject to} \quad \int_{s=0}^{s=1} V\,[e^{o},Y(S)]f(S)ds \geq V^{o} \tag{1}$$

If alternative employment opportunities available to the agent are known to the principal the participation constraint may be written as a strict equality and so the Lagrangian function may be formulated:

$$L = \int_{s=0}^{s=1} U\,[\pi(e^{o},Y) - Y(S)]f(S)ds + \Phi \int_{s=0}^{s=1} V(e^{o},Y(S))f(S)ds - V^{o}] \tag{2}$$

The solution to this maximisation subject to a constraint problem is found by differentiating with respect to Y(S) for all S. This yields the first order condition :

$$-U'\ (\pi - Y^{*}) + \Phi V_{Y} = 0 \tag{3}$$

which characterises the optimal payment schedule $Y^*(S)$ offered to the executive in each state of the world.

(ii) DIAGRAMMATIC INTERPRETATION

This solution is uninteresting in itself unless it can be given an intuitive interpretation. Suppose only two possible states of the world can occur (S_1 and S_2). Then, given that (3) is a condition which needs to be met in each state of the world, we can write:

$$U'(S_1) \;/\; U'(S_2) = V_Y(S_1) \;/\; V_Y(S_2) \qquad (4)$$

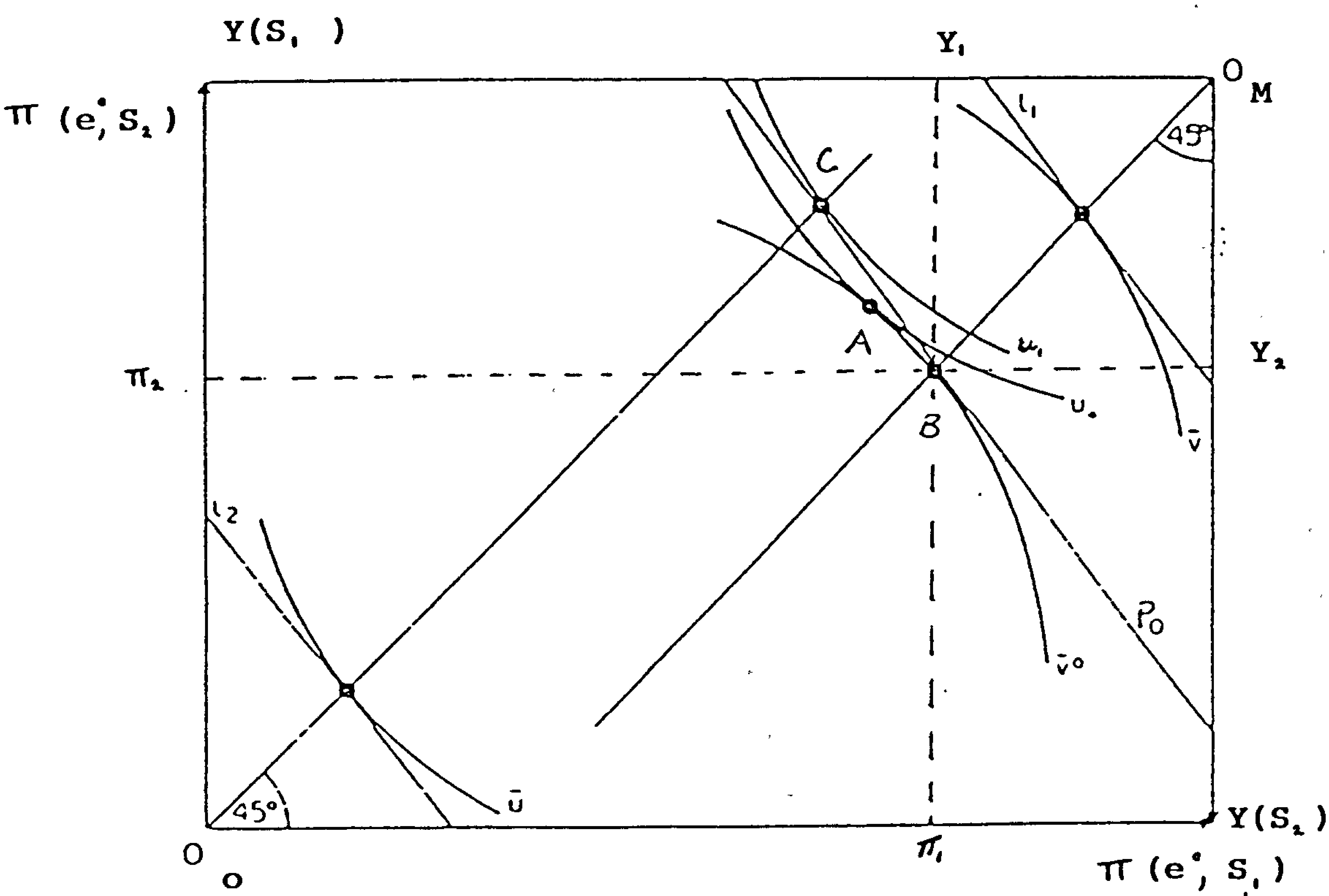
consequently the optimal risk sharing contract is one in which the shareholder's marginal rate of substitution between incomes in the two states of the world is equated with that of the executive. The solution for the optimal contract depends on the risk-attitudes of the two parties.

Consider two special cases. In the first the shareholder is risk-neutral while the executive is risk averse. Then $U''= 0$ so that $U'(S_1) = U'(S_2)$ = a constant. Condition (4) now becomes:

$$V_Y(S_1) = V_Y(S_2) \qquad (5)$$

which is only satisfied if the executive receives the same salary in both states of the world. This implies that the optimal risk-sharing contract in the presence of a risk-neutral shareholder and risk-averse executive is one which fully insures the executive, paying him a fixed salary whatever profit the company makes.

FIGURE 4.1



Optimal risk-sharing

In the second case the executive is risk neutral while the shareholder of the firm is risk-averse. $V_{YY} = 0$ so that $V_Y(S_1) = V_Y(S_2) =$ a constant, implying that the optimal condition is:

$$U'(S_1) = U'(S_2) \qquad (6)$$

which is only satisfied if the shareholder receives a fixed payment and the executive keeps the residual of profits and bears all the risk.

The above analysis can also be undertaken in the framework of an Edgeworth - Bowley box diagram (see Ricketts, 1986). The income received by each if S_1 occurs is measured on the horizontal axes, and income if S_2 occurs is measured on the vertical axes. The shareholder's profit is measured from O_o and the payment received by the executive from the shareholder is measured from O_m. Lines at 45° which begin at O_o and O_m represent lines of certain income. The indifference curves representing different levels of utility show how income in one state of the world is traded for income in the other. Their slope at the intersection with the 45° line is equal to the probability ratio $f(S_1)/f(S_2)$.

The nature of the solution depends on the attitudes to risk which are reflected in the shape the indifference curves of each party: risk-aversion implies that indifference curves are convex to the origin. Let the indifference curve V^o correspond to the executive's reservation utility. Then the optimal solution will be at a point such as A where one of the shareholder's indifference curves is tangent to V^o. Given that both parties are risk-averse this will lie somewhere between the two certainty lines with risk being shared in proportion to the degree of risk-aversion. If S_1 occurs the shareholder receives π_1 and the executive receives Y_1, if S_2 occurs then the shareholder receives π_2 and the executive Y_2. If an individual is risk-neutral then his indifference curves are given by straight lines with slope equal to the probability ratio $f(S_1)/f(S_2)$. This means that if the shareholder is risk-neutral and the executive risk-averse, the tangency point between V^o and one of the shareholder's indifference curves will be located on the 45° line: the executive will receive a certain income no matter what the state of the world. Conversely, if the executive is risk-neutral and the shareholder risk-averse the tangency solution will imply that the shareholder is receiving a fixed payment and the executive is bearing all the risk.

(iii) GENERALISATION

The above analysis can be generalised to examine the possible forms of the optimal payment schedule when multiple states of the world occur. Differentiating the first order condition with respect to S and rearranging we obtain:

$$dy^{*}/ds = \left[(U''\delta x/\delta y)\ /\ (U'' - \Phi V_{yy})\right] \qquad (7)$$

It is helpful at this stage to introduce the Arrow - Pratt measure of absolute risk aversion: following Pratt (1964) it may be interpreted as indicating the amount of the expected income an individual would be willing to forego to receive a certain income. The relationship is as follows

$$R_o = -U''/U' \quad , \quad R_m = -V_{yy}/V_y \qquad (8)$$

which are greater than or equal to zero according to whether the individual is risk-averse or risk-neutral. Substituting these into (7) and noting that from (3) $\Phi = -U'/V_y$, yields:

$$dy^{*}/ds = R_o/(R_o+R_m) \quad d\pi/ds \qquad (9)$$

which demonstrates how the optimal payment varies as profit changes with the state of the world. The optimal fee schedule is obtained by integrating (9) over S.

$$Y^* = R_o / (R_o+R_m)\pi + C \qquad (10)$$

Such a schedule is linear under not very appealing conditions: both individuals exhibit constant absolute risk aversion so that the ratio $R_o/(R_o+R_m)$ is constant. The results established earlier clearly still follow: if the shareholder is risk-neutral $R_o=0$ so that $Y^*=\pi+C$; if the executive is risk-neutral $R_m=0$ so that $Y^*=\pi-C$, (where C is obviously negative and represents some fixed payment to the shareholder).

Empirical observation, however, suggests that individuals exhibit diminishing absolute risk-aversion, implying that the optimal contract will be non-linear, depending on the relative changes in the shareholder and executive willingness to risk some fixed amount of income. This suggests that optimal contracts will be complex in the sense of being non-linear even in the absence of the incentive problem.

The next sub-section addresses the question; how does the nature of the optimal contract change when the effort of the executive is allowed to vary?

(iv) THE INCENTIVE PROBLEM

It is helpful to consider the incentive problem in two stages. In the first case effort is allowed to vary, but the shareholder can observe the level of effort expended. There is no incentive problem as such - the executive can be forced to supply the optimal level of effort.

The problem is essentially the same as that of optimally sharing the risk of a venture, except that this time the shareholder maximises his expected utility with respect to effort as well as the payment.

$$\text{Max} \int_{s=0}^{s=1} U\,[\pi(e,S)-Y(S)]\; f(S)ds$$

$$\text{subject to} \int_{s=0}^{s=1} V[e,Y(S)]\; f(S)ds \geq V^{o} \qquad (11)$$

This yields the two first order conditions

$$-U' + \Phi\, V_{y} = 0 \qquad (12)$$

$$E\,[U'\pi_{e} + \Phi\, V_{e}] = 0 \qquad (13)$$

Where E is the expectation operator.

Note that (12) is identical to (3): the first-best risk sharing optimum is still tenable, but now an optimal level of effort e^* is associated with each $Y^*(S)$, chosen by the shareholder according to relation (13). Following Rees (1985) this may be interpreted as the expected net marginal value product of effort, being set equal to zero.

The incentive problem does not arise when the shareholder can costlessly observe effort because the contract can specify a payment schedule contingent on the executive supplying e^* and containing a "forcing clause" whereby the executive receives $Y(S) < Y^*(S)$ if $e < e^*$. The punishment can be made sufficiently unattractive so as to ensure that the executive supplies e^*.

The real incentive problem arises, however, when the shareholder cannot observe managerial effort. This means that the optimal payment schedule must take account of the fact that, given a particular payment schedule, the executive will choose an effort level which maximises his expected utility. The model is formally written as follows. The executive will maximise:

$$\int_{s=0}^{s=1} V\,[y^*(\pi\,(e,S)),\, e]\, f(S)\, ds \qquad (14)$$

Differentiating with respect to e gives:

$$E\ [V_y\ (dy^*/d\pi\quad \pi_e + V_e/V_y)] = 0 \qquad (15)$$

There is no guarantee that for any given payment schedule, the executives will choose the level of effort the shareholder would like him to supply. Furthermore, the shareholder can no longer force him to supply that level, because he cannot observe effort. The key issue is how to induce the executive to supply an appropriate level of effort. This is achieved at the expense of the risk sharing optimum.

It was suggested above that the conflict between the shareholder and executive arose from the fact that the shareholder is only interested in effort insofar as it affects profitability, whereas effort yields direct disutility to the executive. While the level of effort chosen by the executive is determined by equation (15), the level of effort which the shareholder wants him to expend is determined by equation (13). Remembering that $\quad = U'/V_y$, (13) may be written:

$$E\ [U'(\pi_e + V_e/V_y)] = 0 \qquad (16)$$

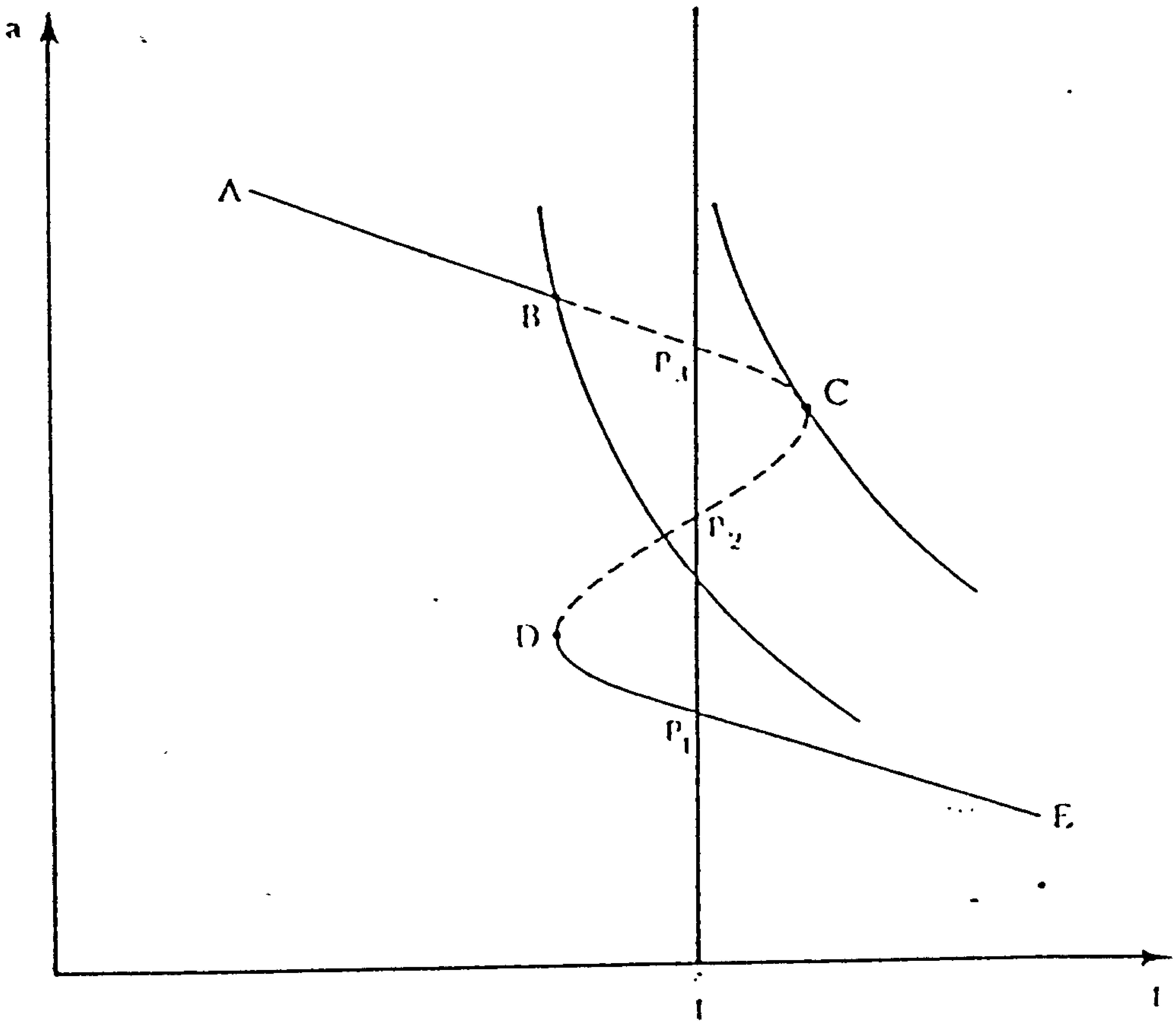
Comparing (15) with (16) it should be noted that the income accruing to the executive from the last unit of his effort $(dy^*/d\pi)\ \pi_e$ is not equal to the marginal product of effort (π_e). Hence a different level of e is implied by these two equations. Suppose the shareholder was risk neutral and offered the manager the optimal risk sharing contract $Y^*=C$. Why should the executive expend any effort at all if he will receive C anyway?

Solving the incentive problem, however, is not as simple as it first appears. Mirrlees (1975) shows that an optimal solution may well not exist if the incentive constraint is added to the participation constraint and expected utility maximised as before. Mirrlees (1974,1975) has suggested an alternative approach, developed further by Holmstrom (1979). Mirrlees and Holmstrom eliminate S from the problem by regarding π itself as the basic random variable. This modification of the problem is a result of the assumption that for every level of e there exists a profit level associated with each state of the world. Each level of profit occurs with probability given by f(S). An increase in e shifts the distribution of π to the right with the proviso that the upper and lower limits are unaffected by e. This implies that an increase in effort improves the likelihood of higher profit levels and reduces the probability of lower profits.

However Mirrlees and Holmstrom's approach does not guarantee a uniqueness of the solution. It turns out that for the unique global solution to exist we require the executive's utility function to be strictly concave in e (Rees,1985,p.18). Mirrlees (1975) argues plausibly that this may not be the case.

The problem is illustrated in the following diagram taken from Grossman and Hart (1983,p.8).

FIGURE 4.2



Let Y be a payment schedule ranked in order of the shareholder's preference from left to right (different schedules generate different sets of contingent incomes to the shareholder). The function e(Y) shows the level of effort, e, which satisfies (15) for each schedule. The function may take more than one value for each Y in a certain interval. For the executive, the points on the solid line (AB DE) dominate all others because he/she will always prefer less e to more. U_o, U_1, represent the shareholder's indifference sets. The optimum for the shareholder is at C, since at this point his utility is higher than at any other point where the executive's first order condition is satisfied. The feasible optimum, however, is at a point such as B, where the shareholder can be certain that he can actually induce the executive to choose the appropriate level of e.

The only way to circumvent this problem is to make one further simplifying assumption. This was the strategy adopted by Mirrlees and Holmstrom.

They assumed that the executive's utility function is additively separable in income and effort ie. $V_{(Y,e)} = V_1(Y) - V_2(e)$. The usefulness of the separability condition can be seen in the simplicity of the first order condition for the maximisation of utility on the part of the executive. The new random variable is π whose density function, $\phi(\pi,e)$, is obtained from $\pi(e,S)$ and $f(S)$. The executive maximand may now be written as :

$$\int_{\pi_0}^{\pi_1} V_1 \, [\ Y(\pi)] \ \phi(\pi,e) \ d\pi \quad - \quad V_2(e) \qquad (17)$$

Taking the first derivative of (17) with respect to e and setting it equal to 0 gives the first order condition :

$$\int_{\pi_0}^{\pi_1} V_1 \, [\ Y(\pi)\ ] \ \phi_e(\pi,e) d\pi - V_2'(e) = 0 \qquad (18)$$

where $Y(\pi)$ is any given fee schedule.

The shareholder now maximises his expected utility:

$$\int_{\pi_0}^{\pi_1} U \, [\pi - Y(\pi)] \ \phi(\pi,e) \ d\pi \qquad (19)$$

with respect to $Y(\pi)$ and e.

Subject to the participation constraint (PC) :

$$\int_{\pi_0}^{\pi_1} V_1 \, [\ Y(\pi)\ ] \ \phi(\pi,e) \ d\pi - V_2(e) \geq V^o \qquad (20)$$

and to the incentive constraint (IC):

$$\int_{\pi_0}^{\pi_1} V_1 \,[\; Y(\pi) \;]\; \phi_e(\pi,e)\; d\pi = V_2'(e) \qquad (21)$$

The conditions which the solution of this problem must satisfy are:

$$[\; -U' + \Phi V_1' \;]\; \phi(\pi,e) + \mu V_1' \;\phi(\pi,e) = 0 \qquad (22)$$

and

$$\int_{\pi_0}^{\pi_1} U \;\phi_e d\pi + \Phi \left[\int_{\pi_0}^{\pi_1} V_1 \phi_e d\pi - V_2'' \right] + \mu \left[\int_{\pi_0}^{\pi_1} V_1 \phi_{ee} d\pi - V_2'' \right] = 0 \quad (23)$$

Where Φ and μ are the multipliers associated respectively with PC and IC. From (18) the middle expression in (23) is zero. (22) and (23) may be written as:

$$U'/V_1 = \Phi + \mu\phi_e/\phi \qquad (24)$$

and

$$E\;(\; U\phi_e \;) = -\;\mu E\;(\; d^2V/de^2 \;) \qquad (25)$$

It is immediately apparent that the first-best risk-sharing optimum is no longer available [compare (23) with (3)]. The optimal contract must take account of the need to influence the executive's choice of effort. Moreover, the simplicity of the earlier results is now lost : the optimal contract depends not only on risk attitudes of the two parties, but also on how ϕ_e and ϕ vary with π. In particular, a risk-neutral shareholder would not pay the risk-averse executive a fixed sum, because the executive would have no incentive to supply any effort.

Holmstrom (1979) demonstrated that the only rule of thumb that can be applied when the incentive problem is presented is to offer the executive a higher payment when the company makes high profits, and a lower payment when the company makes low profits as compared to the payment resulting from the optimal risk-sharing contract. Obviously this rule of thumb is valid only if an increased effort on the part of the executive increases the likelihood of high profits and decreases that of low profits.

There are two situations however, in which the incentive problem does not arise. If the executive is risk-neutral it does not matter that the shareholder cannot observe effort, because in demanding a fixed payment and letting the executive bear all the risk the shareholder ensures that the solution to the executive's optimisation process is the risk sharing optimum itself. In other words the incentive constraint does not bind.

The second case arises when, although e cannot be observed perfectly, it is observed only with some random error ϵ_1 which is independent of the state of the world. If ϵ has zero mean and is normally distributed, the shareholder can simply threaten to pay an arbitrarily low Y if he observes $e < e^* + \epsilon_o$. In selecting the value of ϵ_o the shareholder must weigh up the consequences of wrongly rejecting $e = e^*$ (a type one error) and paying the executive a low salary against wrongly accepting $e = e^*$ (a type two error) and paying him too much.

A final issue addressed in much of the agency literature is the possibility of monitoring. If the shareholder can costlessly acquire certain information about effort in addition to that given by profit, should the shareholder use this information in devising the optimal payment schedule? It can be shown, as in Rees (1985), that it is always optimal to incorporate into a contract any variable which costlessly provides information about effort, except when executives are risk neutral. The importance of the additional information is that it reduces the probability of incorrectly rewarding low e and penalizing high e. This improves the incentive properties of the contract. To come to grips with this issue it is necessary to move from the one-period structure of the preceding analysis to a multi-period analysis of principal-agent relationships.

4.3 SHAREHOLDER - EXECUTIVE RELATIONSHIPS IN A MULTI-PERIOD CONTEXT

The preceding discussion of shareholder - executive relationships has been based on an analytical structure which involves a one-period, non-cooperative game. The two basic steps involved in a game of this type are : the executive obtains a sample of information on the random "state of nature" affecting the firm and chooses a course of action in the form of a specific level of effort; and the shareholder, who can observe the outcome of the executive's action (in the form of, say, the profits earned) but not the agent's level of effort or the "state of nature", pays the executive according to a pre-determined contract in which rewards depends purely on the outcomes observed (say, the level of profits), and not on the level of executive effort or the environment ("state of nature") affecting the firm. The predicted outcome is usually taken to be a non-cooperative Nash equilibrium pinned down by the attitudes to risk of the executive and shareholder.

A fundamental question begged by this method of analysing shareholder - executive relationships is why the two parties do not exploit the possibility of cooperation. In general terms it has been argued that in theories of games, the extent to which behaviour emerges as cooperative or non-cooperative should be determined within the theory (see Binmore, 1987). The specific question is one of what determines the degree of cooperation between shareholders and agents. The conventional wisdom here is that "....cooperation is less likely - or less stable - the more players there are, or the greater the difficulty of communication among the players ... (and) more likely (stable) if there are mechanisms whereby the players make binding commitments" (Radner, 1981,p.1127). It is clearly likely that Nash equilibria will not be Pareto optimal in the sense that solutions to cooperative games can exist which will yield at least the same level of expected utility to one party, and a higher level of expected utility to the other than in the non-cooperative case.

The possibilities of cooperation in shareholder - executive relationships have been analysed by Radner (1981,1985) using the theory of repeated games or "supergames". Here the general case of shareholder - executive relationships which are sustained for more than one time period is introduced, with the actions of the shareholder and executive now depending on the history of the previous sequences in the relationship. The fact that the game is repeated provides the shareholder with the opportunity to observe the executive's action over a number of periods. This accumulation of information opens up the possibility that the shareholder can use the observations of the executive's past actions to draw statistical inferences as to whether the executive's actions have been appropriate

: the executive's effort level remains unobservable, but the shareholder can now use statistical means of drawing indirect inferences regarding the level of executive effort. The further possibility opened up by the repetition of the game is that the shareholder can punish the executive for what can be inferred to be departures from appropriate actions or effort levels. Thus there are now two phases to the game : a review phase in which the shareholder evaluates the cumulative performance of the executive since the last review, and pays the executive according to a Pareto efficient contract designed on the presumption of cooperation; and a penalty phase, arising after an unsatisfactory termination of a review sequence, in which the shareholder punishes the executive for what are inferred to have been inappropriate past actions, and the players revert to a non-cooperative game and a contract which is not likely to be Pareto efficient. Of crucial importance here is the degree of myopia or hypermetropia : ".... since the accumulation of reliable statistical evidence takes time, the threat of future punishment would be less effective deterrent the more the agent discounts future utility" (Radner 1985, p.1174).

At the time of writing, the "new" approach to game theory, in which such crucial factors as the degree of cooperation and pre-commitment in strategies are determined during the sequences over which the game is played, is developing rapidly (see Binmore, 1987 and Binmore and Dasgupta eds 1987, for example). Such developments promise to provide a more satisfactory account of how contractual relationships between shareholders and executives develop during sustained, multi-period relationships which provide the shareholder with the possibility of drawing indirect inferences about the executive's level of effort. This literature has served to highlight several important points germane to the design of optimal contracts. First, there is the question of what type of statistical rule should be used by shareholders to draw the inferences about executive's action (eg. effort levels) from observation of outcomes (eg. profit levels). Secondly, the rate at which executives discount future utility plays a key role, a high rate of discount weakening the impact of future punishments threatened by the shareholder for inappropriate actions (eg. effort levels). Third, there is a clear indication that efficient contracts are likely to involve a contingency for punishment (eg. threat of termination) should a sequence of review phases yield evidence damning to the agent. Fourthly, efficient contracts are likely to be characterised by distinct phases, some characterised by cooperation or adherence to a pre-determined reward schedule, others by non-cooperation and lack of pre-commitment. Fifthly, the issue of who moves first is important : does the executive choose a course of action (eg. effort level) before the shareholder announces the reward schedule, or is the latter pre-determined? (see Radner, 1985, for discussion of the above points).

Thus an efficient contract, when set in the realistic context of a repeated game between shareholder and executive, is likely to be even more complex than the one-period non-cooperative Nash equilibrium analysis would suggest. The literature has begun to grapple with the difficult issues involved in the design of shareholder - executive contracts in a multi-period setting, but has not to date produced a general account of optimal contracts which are efficient in the sense that they Pareto-dominate others. This work, however, has served to highlight features which are likely to be present in optimal contracts.

CHAPTER 5

ARE EXECUTIVE COMPENSATION PLANS DESIGNED TO INDUCE EFFORT OR AVOID TAX?

5.1 INTRODUCTION

The stated aim of executive compensation contracts is to align the objectives of executives more closely with those of the shareholder. Several commentators have suggested however, that such plans are adopted for tax rather than incentive reasons.

Principal-Agent analysis suggests that the optimal incentive contract is likely to be extremely complex, except under certain highly restrictive conditions, [see Arrow, 1985; Fama, 1980; Grossman & Hart, 1983; Hart & Holmstrom, 1986; Holmstrom, 1979; Rees, 1985]. It is reasonable to suggest that companies will tend to forego strict optimality in the design of compensation contracts in the interests of practicality. This raises the question as to whether companies really do address the problem of providing executives with the appropriate incentives. In what follows, the incentive properties of several commonly adopted compensation plans will be considered.

Most of the literature on the tax treatment of compensation plans relates to the United States. The following is not intended as an exhaustive discussion of the tax treatment of executive compensation, but simply aims to provide enough information to demonstrate the tax advantages of the various schemes considered.

Analysis of the properties of the various schemes might provide hints concerning whether the rationale for the plans is derived from tax avoidance or incentive considerations. There have been, broadly speaking, two approaches to the problem of distinguishing between these two rationales. Miller and Scholes (1980) assess a plan for tax advantages by setting the plan up in such a way that the plan does not affect corporate taxes vis-a`-vis an equivalent salary payment, and then investigate the implications of the plan for the individual executive's tax liability. An alternative approach adopted by Hite and Long (1982) places the problem in an historical context. They attempt to explain the shift in the early 1970's from qualified to non-qualified plans by assessing the impact of changes in the tax law on the total of corporate and executive tax liability. The assumption is that the shift took place because the tax treatment changed from favouring qualified to non-qualified plans. The same exercise can be carried out for the Tax Reform Act of 1986 although, unfortunately, not enough time has elapsed to assess the full impact of this reform.

It will be argued that neither of these approaches can provide a conclusive answer to the question. While a tax-disadvantageous or tax-neutral plan presumably suggests that its adoption was due to incentive considerations, we cannot conclude that incentive considerations are absent merely because a scheme is tax advantageous. The fundamental problem is to establish whether tax efficiency is being placed above incentive considerations: the vast majority of schemes considered appear to be tax-advantageous, exacerbating the problem of distinguishing between the two motives.

5.2 COMPONENTS OF COMPENSATION : INCENTIVE EFFICIENCY

There are in general five basic elements in compensation packages: salary, short-term incentive payments, long-term incentive payments, benefits in kind, and perquisites (see, Ellig, 1982; Crystal, 1984). At the lower end of the pay spectrum only salary and benefits usually appear, whereas at the executive level all five components are present. Each component will be considered in an attempt to discern the incentive implications and assess whether incentive considerations are paramount in the form of compensation.

[A]. Salary

The most common component of executive compensation is a pre-specified salary. The objective of the salary element is to reflect the extent of experience and performance required for a job at a particular level in the organisation.

It has been argued that salary renegotiation together with other market control mechanisms provide enough incentives to ensure that executives act optimally (Smith & Watts,1982). The salary can tie executive compensation to the performance value of the firm if it is renegotiated on the basis of the previous year's reported profits or rate of return on capital. The extent to which top management can neglect maximising the market value of the firm is limited by managerial labour market considerations. If executives perform badly, the only factor preventing their removal from office is the cost of that removal, which is finite.

Appraisal

Nevertheless, neither labour market forces nor salary renegotiation can completely eliminate opportunistic behaviour. The reasons are threefold: first, without an incentive programme risk averse managers will tend to avoid risky projects. They are reluctant to compromise their current situation. A fixed salary contract offers little reward for taking risks to improve shareholder's wealth. It may even encourage the executive to undertake some investment projects which actually reduce the value of the firm. Executives can be induced to take risks if compensation plans are tied directly to the return on riskier investments.

Second is the "time - horizon" problem. Executives are only concerned with the performance of the company during their period of tenure, whereas the company is, at least potentially, infinitely - lived. Executives may therefore pursue strategies which are in the short-term interest of the company but which may be detrimental to long-term profitability.

Finally, it is in the interest of executives to retain a large proportion of company profits to cover their fixed salary payments. This is in direct conflict with the interests of shareholders, who would prefer larger dividend pay-outs, or the retention of profits within the company to finance projects which would increase the net worth of the company.

The principal-agent literature attempts to provide a theoretical solution to the incentive problem. In this section we wish to examine the extent to which the compensation schemes employed came to grips with the incentive problem.

[B]. Short-Term Incentive Schemes : Bonus Plans

Short-term incentive plans are designed to reward executives on the basis of recent corporate performance: the most common type of scheme is the bonus plan. Typically a bonus plan involves the executive being rewarded at year end on the basis of the year's performance: performance is measured variously as a function of profits, return on investment, or more specifically, earnings per share, return on stockholders equity, return on capital employed, return on assets, although some plans allow executives to defer payment until they retire. Such plans normally specify a minimum level of profits, or return on investment, which must be reached before a bonus can be awarded. There are also plans which specify a maximum level of bonuses in relation to dividends paid-out.

Appraisal

The incentive properties of short-term incentive plans are evident : they attack the problem of risk-aversion to some degree by formally rewarding executives for increased profitability. The schemes which tie bonuses to dividend payments also reduce any incentive executives may have to retain large profits. The horizon problem, however, is exacerbated by such schemes, since they focus the executive's attention on short-term measures of performance. This problem is ameliorated by the few plans which require bonus awards to be paid in installments over several years.

[C]. Long-Term Incentive Schemes

While short-term plans typically have a time span of one year, long-term schemes usually refer to a period of three to five years, and in some cases beyond. There is occasionally evidence of a medium term, three to five year restricted stock and performance unit plan for example, as well as a long-term plan, stock options and stock appreciation rights beyond the five year. The present discussion will combine these two categories. There are wide variations among long-term incentive schemes: the following discussion deals with the more common plans.

(i). Stock Options : Qualified and Non-Qualified

A stock option is the right to purchase a stated number of shares in a company at a pre-stated price, within a stated period of time. The difference in status between a qualified and non-qualified stock option derives from their tax treatment. The most common type of qualified stock option is the incentive stock option (ISO). To "qualify" for I.S.O. status a plan must satisfy certain minimum requirements: the option price must be not less than 100% of fair market value at time of issue; the period of the option must be not more than five years; and stock acquired by exercising the option must be retained for longer than three years. It used to be the case that a qualified option could not be exercised while a previously granted option at a higher price was outstanding, but this requirement has since been relaxed.

Non-qualified options, on the other hand, tend to have few legal requirements: the option price can be set at less than the fair market value; and there is no legally binding holding period, although most involve a few months to avoid insider trading problems.

(ii). Stock Appreciation Rights

Recently the issue of stock options is frequently accompanied by Stock Appreciation Rights (S.A.R's) which, upon exercise, entitle the executive to receive the difference between the market value of the stock and the option price in cash and / or stock. The purpose of such rights is to enable the holder of the options to realize the increase in market value of the stock without the need to borrow, sell securities, or otherwise deal in capital. The rights also reduce transaction costs. S.A.R's may be issued in connection with the granting of non-qualified or incentive stock options, but if granted in connection with an incentive stock option they come under the stricter requirements of such options.

(iii). Restricted Stock Plans

Under a restricted stock plan the company awards shares to executives conditional upon the achievement of a certain standard of performance, subject to restrictions on sale. The shares may be allocated free of charge or for a nominal price. The executive's right to ownership of some or all of the shares in question (vesting) is generally made contingent on the executive remaining in employment for a certain period though occasionally other restrictions are imposed. The plan typically requires forfeiture of unvested shares if the executive leaves during the restriction period, though vested shares may also be forfeited. The stock may vest (lose its restriction) ratably or non-ratably according to a prearranged schedule.

(iv). Phantom Stock Plans

Phantom stock plans are to restricted stock plans what stock appreciation rights are to stock options, but they are based on "phantom" rather than real shares of company stock. Conceptually, the term " phantom stock" can describe any form of long-term incentive plan using units that are equivalent to but not actual shares in the company. For the purpose of this discussion, we will focus on the more traditional definition of the term, which is quite similar in most respects to stock appreciation rights.

Instead of being awarded shares received when restricted stock becomes vested, the executive is merely credited with units analogous to the company shares, and at the end of the restricted period is paid the cash value of the shares. Dividend equivalents are also sometimes paid or accrued on phantom stock, which means that the executive receives or has allotted to him / her a sum equal to the dividends paid on the imaginary stock.

(v). Dividend Units

Dividend unit schemes are similar to phantom stock plans: the executive is awarded a number of dividend units instead of phantom stock shares. Instead of being compensated in terms of the appreciation of the stock price at the end of the award period, the executive is compensated on the basis of dividends paid to shareholders.

(vi). Performance Unit and Performance Share Plans

All the plans discussed above, with the exception of dividend units, rely on share price to determine the actual compensation received by the executive. Compensation under performance unit or performance share plans however, depends on the degree to which prescribed goals are met. The goals are formulated in terms of accounting measures, earnings per share, growth in earnings per share, rate of return on assets, for example, at the beginning of an award period, which usually ranges from four to five years.

A performance unit programme differs from a performance share programme only in that the former involves the credit of a given number of units of fixed money value, whereas the latter involves a credit of units whose value is geared to that of the company stock. In both cases the executive's compensation is determined by the number of units or shares he or she has "earned" multiplied by either the fixed value of those units or the price of the company stock.

Appraisal

What are the incentive properties of these plans? It has become apparent that the aim of all the above programmes is to tie the executive's compensation to the long-term performance of the company. In other words, they are designed to overcome the time horizon and risk inducement problems. This is accomplished either by allocating a potential equity interest in the company to the executive, thereby providing an incentive for the executive to promote the growth or profitability of the company; or by rewarding him for attainment of other long-term goals.

Several important considerations make the attainability of this objective questionable. While most plans stipulate forfeiture of options on termination of employment, this being legally binding, many companies waive this requirement under pretexts which can be flimsy. For example, they often award "severance pay" or a "consulting contract" even when the forfeiture provisions are invoked.

With the exception of performance unit and share programmes, all the plans considered are non-goal orientated: the company does not have to prescribe certain goals which must be achieved in order that payments be made.

Whilst in some respects this may be an advantage, in others it may not, since it can make the link between compensation and performance very tenuous indeed. The reason for this is that "share prices are influenced by three broad factors: (1) the general performance of the economy, including changes in interest rates, inflation, and real economic growth; (2) the performance of the given industry; and (3) the quality of management within a specific firm". (Putnam & Zimmer, 1987, p.41) In essence, a highly competent management team which expends an optimal amount of effort "would determine only about half of the company's value"(Putnam & Zimmer, 1987, p42). Macroeconomic factors have a large impact on the overall executive compensation. In a "Bull Market", executives can expect to receive above average compensation for mediocre performances. Conversely, in a "Bear Market" superior performance may be penalized because of poor overall market conditions.

A way of overcoming this problem would be to reward executives on the basis of an inter-firm comparison of share-performance. This would remove the influence on rewards of market and industry conditions which are beyond the control of executives. Some companies have begun to do this, but by no means the majority.

Finally, some have argued (see Ellig, 1982) that options simply motivate the recipients to attempt to manipulate the price of the stock, rather than improve company performance.

[D]. Perquisites and Benefit - Related Devices

Perquisites (Perks) are essentially employee benefits which are designed to apply only to executives. In some instances they merely supplement employee benefit coverage; in others they provide a coverage absent from the employee benefit programme. For this reason we consider both perquisites and benefits under the same heading.

It would be impossible to discuss the wide variety of benefit related schemes here: instead we will deal with some of the more controversial schemes, examining the incentive properties and shortcomings.

(i). Deferred Compensation Plans

Deferred compensation arrangements are designed as a means of allowing executives to forego current income, and therefore current taxation, until retirement or some other later date, when they will enjoy the benefits of a lower income tax bracket. Although some plans provide for a deferral of salaried income, the most common arrangements involve deferral of a portion of bonus income. The most popular form of deferred payment is in cash, which is credited with an interest factor under a predetermined formula.

Deferred compensation plans can provide incentives in several ways: they can augment any tendency of the basic compensation package to tie senior management to the company; they can act as a pension supplement to attract key employees who might otherwise suffer a reduction in benefits as a result of a mid-career employment change; and they may provide an important form of incentive compensation in companies with a narrow shareholder base which do not wish to dilute their share-ownership.

The main drawback of such plans, however, is the insecurity of the promise to pay, but in some senses this is precisely what is desired. If executives perform badly after earning deferred bonuses, the company may fall into liquidation and be unable to pay.

(ii). Life - Insurance

Any review of the fringe benefit programmes that a company may provide for its executives must give consideration to life insurance. Benefits of this nature can take many forms: the most basic is whole life insurance, which denotes the period of protection. However, it is typically a group insurance scheme which provides the basic insurance benefits that the company is willing to offer its executives. The group covers a set of eligible employees and typically provides insurance coverage until the employee leaves or the contract expires, the contract usually being renewed annually. In addition, business travel protection, dependant coverage and post-retirement coverage, to name but a few, may be negotiated as an extension to the basic scheme.

A currently popular variant in the design of life insurance schemes is the so-called "split-dollar insurance policy". As the name implies the premium costs and death benefits are shared between the firm and the employee. In the simplest version, the corporation pays each year a proportion of the level premium equal to the annual increase in cash value, the balance being paid by the employee. Since employer cost is tied to the increase in cash value of the contract, the policy must by definition be permanent rather than term in nature, since the latter has no cash value.

One major benefit of insurance coverage is that it can act as a "golden handcuff", especially to executives reaching retirement age. For older executives the cost of replacing insurance if they leave the company may be prohibitive.

(iii). Low or No-Interest Loans

A popular trend in executive compensation has been to introduce a low or no-interest loan scheme for key executives. These loans can be tied directly to executive performance with clauses which state that the loan obligation will be reduced or eventually forgiven, if specific objectives are achieved. Such loans are often also tied indirectly to company performance, because they are awarded in connection with stock option plans: executives are loaned the funds to enable them to exercise their option in the company stock.

In addition to the obvious benefits of executive access to "cheap funds", low or no-interest loans can serve as effective incentives when meaningful and achievable performance standards are used as conditions for loan forgiveness. They may also form an effective "golden handcuff" if the executive is obliged to repay the loan on termination of employment. Conversely, such loans may prove to be detrimental to the relationship between executive and shareholders: a large body of such loans obviously reduces the funds available for dividend pay outs or new investment projects.

(iv). Golden Parachutes

Another advantage of special compensation packages can be seen by considering the merger problem. Following a successful merger it is common practice to reorganise the structure of the newly acquired company. This often involves a management reshuffle, making it necessary for shareholders to compensate managers for any loss of status or income, in order to minimise resistance to economically efficient bids. This is achieved by offering executives what have now come to be known as "golden parachutes". Such agreements provide executives with the option of "pulling the rip-cord" if they do not fit in with the new management structure (Cochran & Wartick, 1984; Lambert & Larcker, 1985). The term "golden parachute" is apt: it refers essentially to a safety device for the executive, guaranteeing his financial security in the event of a merger; it provides severance pay if the executive contract is terminated following a change of control; it is golden because it is often very lucrative for the executive.

Companies advance a variety of reasons for employing golden parachutes: senior management is less likely to "jump ship" in the uncertain environment created when a company is a likely takeover candidate; the executives will focus their attention upon managing the company, not seeking other employment; accordingly they will negotiate for the best financial terms for the company in a merger that appears inevitable and will not use their energies to block the tender offer; and it is often necessary but difficult to recruit senior executives into troubled companies.

The incentive properties of golden parachutes appear numerous. Nevertheless, one must be wary of the motives underlying the implementation of such agreements. Are golden parachutes employed to provide executive protection, or used to thwart unfriendly suitors? Severance pay may prove too costly to the suitor company. How vulnerable is senior management to redundancy in a merger situation? If there is little probability of redundancy, then golden parachutes are inappropriate.

Finally, it is worth mentioning that "golden parachutes" have a poor public image.(Weinstein, 1985). They are viewed as nothing more than lucrative "cozy relationships" between company directors and their top executives. If golden parachutes are legitimately beneficial to all parties then companies need to explain this rationale to shareholders.

5.3 TREATMENT OF INCENTIVE PAYMENTS IN THE U.S. TAX SYSTEM

It is unnecessary to give a complete account of the tax treatment of executive compensation (for a comprehensive account, see Business Lawyer, 1984). The purpose of this section is to indicate the salient features of the U.S. tax system in order to help categorize each plan according to whether it is tax-advantageous or otherwise. The aim is to distinguish between tax and incentive considerations which lead to the adoption of particular plans.

Compensation plans affect the taxes of both the executive and the company, so both tax effects must be considered when assessing the tax advantages of any type of plan.

Taxation of Executives

As far as the executive is concerned, the general rule of thumb is that he is obliged to pay income tax on amounts received as compensation. In the case of straight salary for example, the salary constitutes taxable income to the executive in the year it is paid to him [Internal Revenue Code 1954].

There are, however, two aspects of the tax system relating to executive compensation which can provide the executive with more favourable tax treatment.

The first relates to capital gains tax. If the executive can arrange to receive compensation in such a way that it is subject to capital gains rather than income tax, then the tax burden will be reduced commensurately. The extent of this reduction will depend on the difference between the capital gains tax rate and the income tax rate.

The second aspect of the tax system which provides the executive with favourable tax treatment is the opportunity to postpone income tax liability. In general it is true to say that the executive is not liable for tax until he actually receives the income or stock.

The primary obstacles to be overcome if the executive is to receive favourable income tax treatment are encapsulated in two related doctrines: constructive receipt and the economic benefit doctrine (see section 451 of the I.R.S. Code of 1954, as amended 61, 1982). These doctrines can be used by the Internal Revenue Service (I.R.S.) to argue that the executive should be currently taxable on deferred compensation.

The doctrine of constructive receipt has been applied, usually unsuccessfully, to challenge various forms of compensation deferral. It says that all items of income should be included in gross income when they are actually or constructively received. Income is deemed to be constructively received by the executive if it is received "in the taxable year during which it is credited to his account, set apart for him or otherwise made available so that he may draw upon it at any time, or so that he could have drawn upon it during the taxable year if notice of intention to withdraw had been given. However, income is not constructively received if the taxpayer's control of its receipt is subject to substantial limitations or restrictions" (Shultz 1984, p.223)

Similarly, the application of the economic benefit doctrine mandates the inclusion within the executive's taxable income of "any economic or financial benefit conferred on the employee as compensation, whatever the form or mode by which it is effected"(Shultz, 1984, p.224).

The two doctrines are now encapsulated in one code which states that property transferred to an executive in connection with the performance of services becomes taxable to the extent of the difference between fair market value and the amount paid, if any, for the property when it is "transferable", or no longer subject to "substantial risk of forfeiture". A substantial risk of forfeiture "exists where rights in property that are transferred are conditional... upon the future performance... of substantial service by any person.."(Shultz, 1984, p.225; also see, Treas. Reg.1.83 - 3[c][1]1978). Thus, "Conditional Transferability" and "substantial risk of forfeiture" are key elements which enable compensation plans to qualify for tax deferral.[I.R.C. 83(a)]

Taxation of Companies

The main issues of interest in the tax treatment of companies are whether the compensation paid by the company is deductible from corporate tax liability, and how such deductions may be timed. The principal requirements for compensation to be deductible are that the expense must be "ordinary and necessary", and that in the case of executive compensation, it is "reasonable": "There shall be allowed as a deduction all the ordinary and necessary expense paid or incurred during the taxable year in carrying on any trade or business, including - a reasonable allowance for salaries or other compensation for personal services actually rendered....." (I.R.C.162[a][1]1982).

Straight salary payments easily meet the "ordinary and necessary" and "reasonable" tests, but executive incentive programmes must be carefully scrutinized for the "reasonableness" of the compensation.

In addition to the issue of deductibility, the timing of the deduction is important. A general rule of thumb is that if the compensation is includable in the gross income of the executives and, therefore, subject to income tax, it constitutes a deductible expense to the company in the year in which it is included in the executive's income.

(i). Bonus Plans : for income tax purposes, an executive is normally taxed on his annual award in the year of receipt on the same basis as if it were salary. If the annual award is paid in the form of unrestricted stock, the executive will have to pay ordinary income tax on the full market value of that stock; if payment is in the form of restricted stock, however, it will be treated as such for tax purposes (see infra). The tax treatment of deferred bonus compensation will also be discussed later.

(ii). Qualified Stock Options : qualified stock options "qualify" for capital gains tax treatment, the most common of which is the incentive stock option discussed above. If all the requirements are met for the plan to be treated as an incentive stock option, the executive is not liable to income tax at the time of grant or at the time of exercise, but only upon sale of the shares. This means, however, that incentive stock options are not deductible to the company because they are not subject to income tax.

(iii). Non-Qualified Stock Options : in the case of non-qualified stock options, that is, options which do not satisfy one or more of the exemption conditions enumerated above, the executive is subject to ordinary income tax. This tax will usually be imposed on the difference between the fair market value of the stock at the time of exercise and the exercise price. Non-qualified stock options do not ordinarily result in taxable income at the time of grant unless the option is immediately transferable, not subject to "substantial risk of forfeiture" or has a "readily ascertainable market value", which will be the case if the plan is funded. In addition, any difference between the fair market value at time of exercise and the price obtained upon eventual sale of the stock may be subject to capital gains tax. If, on the other hand, the sale price is less than the exercise price, no amount will be included in the optionee's income as compensation, and a capital loss will be recognised. The company is allowed a business expense deduction at the same time as the compensation is recognised as gross income to the executive.

(iv). Stock Appreciation Rights: upon exercise of such rights, irrespective of whether they are granted in connection with an incentive stock option, the executive is subject to income tax on any cash received, or on the fair market value of any shares received. If, however, the shares received are nontransferable or subject to substantial risk of forfeiture, they are treated as restricted stock and taxed accordingly (see infra). The company is once again entitled to a tax deduction at the time and to the extent of the executive's taxable compensation, so that if the executive receives restricted stock the company is not entitled to a deduction until such shares become taxable to the executive.

(v). Restricted Stock Plans: the executive must include in gross income the excess of the then fair market value of the restricted stock over the price paid , if any, in the first year in which the restrictions lapse; this makes the stock transferable and no longer subject to substantial risk of forfeiture. This usually occurs when the executive can sell or otherwise transfer the stock: at this juncture the compensation becomes deductible to the company.

(vi). Phantom Stock Plans: these are treated in precisely the same fashion as stock appreciation rights and become taxable to the executive, and deductible to the company, at the time the awards are eventually settled in stock, cash or both.

(vii). Performance Unit and Performance Share Programmes: a performance unit or share programme made contingent on the attainment of specified goals over a period of years is not normally subject to income tax until the completion of the programme, even though the goal may be reached in earlier years of the programme. The reason for this is that the goal cannot properly be considered as attained until the programme has been completed: the last fiscal year of the programme could conceivably eliminate the goals attained during preceding years. Hence a substantial risk of forfeiture remains. For the company, a deduction in connection with such programmes will be given in the year in which the award is included in the executive's gross income.

(viii). Deferred Compensation Plans: the attraction of deferred compensation arrangements is the ability to postpone taxation until a period in the executive's life in which he is enjoying a lower tax rate, such as during retirement. It should be stressed, however, that the postponement of taxation is allowed only if the promise to pay is unsecured and unfunded, so that it is subject to "substantial risk of forfeiture". Furthermore, companies must be careful to avoid the pitfalls of the constructive receipt and economic benefit doctrines outlined above. As a result of the tax benefits to the executive, however, the company will not be allowed to deduct such compensation expenses until the taxable year in which the deferred amount is included in the executive's compensation.

(ix). Life Insurance: in the case of a group term life insurance plan, the executive must include in his gross income the cost of company-provided life insurance yielding benefits in excess of $50,000 dollars. The proceeds are non-taxable to the beneficiary and if the executive transfers "incidents of ownership" to the intended beneficiaries, he can avoid taxation on the proceeds of his estate. The premia paid by the company are fully tax deductible. In the case of individual life insurance arrangements, the potential tax impact depends on who owns the policy and who pays the premia. If the employee owns the policy and the company pays the premia, the premia are additional income to the employee and deductible to the firm. If the company owns the policy and pays the premia, the premia are not deductible, but neither are they included in the executive's income. It is a little difficult, therefore, to define the precise tax consequences of "split-dollar insurance" because costs and benefits are shared between the firm and the executive in a variety of ways. It suffices to say that they are likely to give rise to taxable income but at a lower rate.

(x). Low or No-Interest Loans: interest-free or below-market rate loans are treated for tax purposes as if they involve an actual payment of interest from the borrower to the lender at rate of interest specified by the Treasury. Such interest payments are deductible to the executive. The difference between this imputed interest and the interest, if any, actually paid by the executive, however, is treated as additional compensation and taxed accordingly. This means that the executive's outlay in interest payments can offset the compensation income which is attributed as a result of the interest-free or below-market rate loan. If the loan is forgiven then it becomes subject to ordinary income tax in the year in which it is forgiven. The company must wait until the executive receives loan forgiveness before it can claim tax deduction, which means that the company cannot make a deduction for the "bargain" element of the loan. The I.R.S. has been trying for years to argue that the recipients of such loans should be taxed on the value of this benefit, but has been largely unsuccessful until recently. The Tax Reform Act 1986, however, has dealt a significant blow to the benefits of low or no-interest loans. It limits the deductions for interest payments to those incurred in connection with trade, business or those related to residential mortgage loans. Hence, the all important question is going to be the category within which the use of funds falls.

(xi). Golden Parachutes: Public criticism of golden parachutes is reflected in their tax treatment (Sections 280G & 4999 of the Tax Reform Act 1984). The 1984 Act prohibits the deduction by the company of parachute payments if (1) the payments are made to an officer, director or highly compensated executive of the company; (2) if the payments are contingent on a change of control and (3) if the payments exceed three times the executive's base salary. Futhermore, any payment received by the executive in excess of his base salary is liable to a 20% excise tax in addition to ordinary income tax.

5.4 TAX AVOIDANCE VERSUS INCENTIVE CONTRACTS

We now turn to the problem of identifying the motivation underlying compensation plans. The question can be posed in terms of why the company does not award the executive a straight cash payment for the performance of services. In the first section we outlined some convincing arguments to suggest why compensation plans may be implemented for incentive reasons. The second section, however, pointed to the tax reasons why such non-basic plans may be introduced.

In the literature there have been two main approaches to the problem of distinguishing between the incentive and taxation motives. The approach adopted by Hite & Long(1982) places the problem in an historical perspective. They attempt to explain the shift in the early 1970's from qualified to non-qualified plans by assessing the impact of the changes in tax law contained in the Tax Reform Act, 1969; Hite and Long focus on the combined tax liability of the company and its executives.

In the 1960's qualified stock options were the predominant form of long-term incentive plan in the United States. In the early 1970's firms replaced these plans with non-qualified stock options. Hite & Long (1982) suggest several hypotheses which could explain this shift, but argue that although "these competing explanations cannot be rejected a priori they are deficient in one crucial respect: they do not explain the timing of the switch" (p.6). They conclude that "the tax hypothesis based on the Tax Reform Act of 1969 provides an explanation consistent with the form and timing of the switch"(p.6).

The 1969 legislation contained special provisions in terms of treatment of capital gains for qualified stock options. Prior to 1969, the tax advantages to the executive of qualified stock options far outweighed the lack of deductibility for the company, this was no longer the case post 1969. The 1969 Tax Reform Act served to lower the standard income tax rate from 70% to 50% by 1972, so that the corporate tax savings with non-qualified plans swamped the personal tax advantage of the qualified plans. Consequently, compensation plans were modified to take advantage of this tax saving.

This exercise could be carried out for all tax reforms, observing the consequent shift, if any, in compensation plans adopted. For example, the 1986 Tax Reform Act has reduced income tax from a maximum rate of 50% in 1986 to 28% in 1988; has increased the maximum capital gains tax to 28% by 1987; and lowered corporate tax rates, although corporate tax rates for the first time will be higher than the rates applicable to individuals. Thus we would expect to observe a shift away from plans which do not permit corporation tax deductions. Since an employer can rarely receive a deduction when an employee is liable to capital gains tax, we would expect a shift away from techniques that generate capital gains (see, Walter, 1987; Weinstein, 1985).

Nevertheless, the usefulness of this exercise is questionable. The only point it highlights is that companies take the tax consequences of their compensation plans seriously. It says nothing about incentive considerations. In order to demonstrate that companies were placing tax-efficiency above incentive considerations it would be necessary to show that companies adopt compensation plans with inferior incentive properties in response to tax changes. This, however, is easier said than done. One has to ask whether differences in tax treatment apart, there are good grounds for preferring one plan to another. Miller (1977) has suggested that the wide variation in plans may simply represent "...neutral mutations that serve no function, but do harm"(p.265). Others have argued (see, Brickley, Bhaghat & Lease, 1985; Tehranian & Waegelein, 1985) that it is extremely difficult to demonstrate the superiority of one plan over another because the plans represent a response to differing corporate needs. Hence explaining the cross-sectional variation in non-qualified compensation arrangements, which receive similar tax treatment, may prove to be a fruitful area for future research.

An alternative approach to distinguishing between tax and incentive motivations adopted by Miller & Scholes(1980) and Smith & Watts(1982) categorises plans according to whether they are tax-neutral, tax-advantageous or tax-disadvantageous. Any scheme whose tax consequences are equivalent to what they would have been had the individual received the payment in cash and invested it himself is said to be tax-neutral; and tax-disadvantageous or advantageous if higher or lower tax payments are involved.

The rationale behind this approach is that "the absence of clear tax benefits creates the presumption that the schemes must have compensation incentive benefits to justify their use" (Miller & Scholes, 1980, p.184). However, where the plans are tax-advantageous, which is often the case, there is an identification problem. The presence of tax advantages does not preclude the possibility that the scheme is an incentive plan which has incidental tax benefits.

Compensation plans affect the taxes of both the company and the executive, but to avoid the problem of comparing disadvantages to the company with advantages to the executive and vice-versa, the Miller & Scholes(1980) approach sets each plan up in such away as to make it tax-neutral to the company.

On first inspection the advantages of restricted stock plans, phantom stock plans and performance share programmes appear ambiguous. If the company stock price rises between the time of grant and the date the restrictions lapse then participation in the scheme is superior to purchasing the company stock with after-tax current salary, no capital gains tax being paid on the subsequent increase in share price. If, however, the share price falls, the blow is cushioned for the non-participant by the capital loss deduction.

This ambiguity may seem to support the presumption that restricted and phantom stock plans are popular because of their incentive properties. But Miller & Scholes(1980) demonstrate that a trade of some deferred wages which yields a mixed portfolio will lead restricted and phantom stock plans to dominate the purchase of company shares with the after-tax proceeds of current salary. The authors therefore conclude "with minor qualifications" that such plans are tax-advantageous. This qualification relates to the exemption from capital gains tax of assets held until death (TRA 1976): if the executive does not sell the shares before death, the combination of stock, plus current or deferred wages, may not be the dominant compensation plan in all circumstances.

The advantage of non-qualified stock options and stock appreciation rights are analogous to those of restricted stock or phantom stock relative to direct stock purchase: there is no capital gains tax payable on any appreciation over the life of the option; and the seeming advantage of capital loss deduction under direct purchase in the event of a fall in the firm's share price can be offset by a package combining non-qualified options and current (or deferred) salary. Note that we do not consider qualified options because under the present tax regime such plans are considerably inferior to non-qualified options.

Stock purchase plans, on the other hand, in which the company lends the executive the funds with which to purchase the company's shares, are shown to have no tax consequences. This is true even if the interest charged on the loan is considerably below the going rate for comparable risks because the value of the interest subsidy does not have to be declared by the recipient, and it cannot be deducted from corporate tax liability. Positive taxes may be payable if the share price falls so that stock purchase plans can be tax-disadvantageous. Thus interest free loans carry no tax advantages. This leads to the conclusion that whatever the objectives of stock purchase plans may be, reaping tax gains is not one of them.

In a similar fashion Miller and Scholes (1981) have demonstrated that bonus and profit - sharing plans tied to internal accounting measures are tax-advantageous. Since profit-sharing and bonus plans call for payments when earnings are positive, they are equivalent to options on a hypothetical stock. The tax consequences are, therefore, exactly the same as they are for a stock plan.

The advantages of straight cash deferral derive from differences between corporate and personal tax rates. If the two rates are the same a simple deferred salary arrangement can easily be seen to be tax-neutral to both parties: the executive who does not participate in the scheme can invest in a risk-less bond and receive the same return as the individual who participates in the plan, assuming a constant marginal rate. Similarly the plan is tax-neutral to the company because it can hedge its commitment to the executive by investing the foregone salary payments in risk-less bonds. The picture changes, however, when marginal tax rates differ between the two parties. If the executive's tax rate exceeds that of the company, which has been the case for top executives until recently, then deferred compensation schemes can be shown to be tax-advantageous. The reason for this is that the interest paid to the executive on the foregone salary will only been taxed at the corporate rather than personal rate. The potential gain increases if the executive's tax rate falls on retirement. By similar reasoning, if the corporate exceeds the personal tax rate, deferred compensation schemes are tax disadvantageous.

Until the recent movement to corporate marginal tax rates in excess of personal tax rates it was not difficult to find a tax avoidance rationale for the adoption of deferred compensation schemes. With the new tax structure it might be thought that the continued adoption of such plans would provide evidence in support of the incentive hypothesis. This argument, however, does not necessarily follow since the benefits of deferring compensation until the lower tax rate encountered by retirement may outweigh the disadvantages of the corporate rate exceeding the present personal tax rate.

Life insurance plans on the surface would appear to be tax-advantageous since life insurance policies are subject to favourable tax treatment: the proceeds of life insurance policies are not taxed as income to the beneficiary, and the earnings on the savings portion of the policy accumulate at the before-tax riskless rate of return. In the present context, however, such plans are essentially tax-neutral since the tax-advantages are no greater than the individual could obtain by buying insurance directly with after-tax current salary. There are, however, two exceptions.

The first is the case of group life insurance. This is tax-advantageous because the company can deduct the full premium whereas the executive is obliged only to include in taxable income the cost of coverage in excess of $50,000. In turn the liability for tax is deferred using a uniform premium profile, the values of which are substantially below those obtained from ordinary commercial sources.

The second exception is the split-dollar plan, which on the surface seems to be tax-neutral. Closer inspection, however, reveals more subtle tax-advantages. Some executives may find that they wish to have more life coverage at some stage in their career than they can actually afford. One way to do this would be to borrow the money, but the tax law prohibits interest deductions if a loan is used to pay more than three of the first seven premia on an insurance scheme. Split-dollar plans avoid this problem by allowing the executive to acquire the whole policy only in return payment of the value of the firm's share in the policy.

On balance the conclusion is that deferred compensation schemes involving life insurance are never worse than tax-neutral and can be tax-advantageous particularly in the case of the currently popular group and split-dollar plans, tax-advantageous when the full set of tax and market restrictions on individual ownership of policies are taken into account.

5.5 CONCLUSION

Most of the compensation schemes considered turn out to be tax-advantageous, which means that we cannot be sure whether the plans are really designed to share the efficiency gains arising from incentive contracts, to transfer some of the salary burden to the Treasury, or both. The essential difficulty is that tax-efficiency is desirable even when compensation plans are adopted for predominantly incentive reasons. The evidence reviewed above cannot distinguish between tax and incentive motivations, especially when plans are tax-advantageous.

Certain intuitive arguments, however, can be employed to question the explanatory power of the hypothesis that compensation schemes are merely tax avoidance vehicles. First, the examples used to demonstrate the tax advantages of incentive provisions suggest that the same tax advantages could be obtained without establishing a formal plan tying compensation to performance, that is, without having an incentive plan. For example, basic salary compensation allied with salary deferral can yield the same tax advantages as basic salary allied with share options. Hence why, if incentive considerations are not important, should companies offer compensation plans involving shares in the company?

A second argument relates to straight salary deferral. Deferral is likely to be tax disadvantageous when executives' personal tax rates are less than the corporate tax rate. Yet it is typically lower level managers facing, if anything, lower marginal tax rates on personal income, who receive compensation in the form of deferred salary.

A third consideration is the strictness of the conditions attached to compensation plans: to the extent to which such strictness is not required for tax avoidance purposes, support is provided for the incentive hypothesis. It has been argued that tax considerations cannot explain the differences in the nature of performance measures across compensation plans. If the plans were designed to provide individual managers with incentives to make decisions in the shareholders' interests, one would expect compensation to be tied to a measure of performance which most reflects executive effort. Measures of overall company performance such as share value and total profits may be appropriate in relation to the efforts of senior executives, but it makes more sense for divisional executives to be evaluated on the basis of divisional measures of performance. Smith and Watts(1982) cite evidence to the effect that performance is evaluated using disaggregated yardsticks, though bonuses are rarely paid if overall corporate performance does not reach some minimum standard.

Finally, it was observed above that incentive plans can be designed to tackle the inducement to risk problem. If this is the case we would expect incentive plans to be more prevalent in unregulated industries where it is easier to alter the risk profile of investment. Again Smith and Watts(1982, p.155) provide evidence to this effect.

According to Principal-Agent analysis the optimal incentive contract is likely to have a high degree of complexity. Such a contract would be almost impossible to implement, which raises the question as to how companies can best design second-best contracts to deal with the incentive problem. In Section II we examined the most commonly adopted schemes and discussed their incentive properties. A central problem here is as follows: if firms are seriously concerned about incentives, why do they tie compensation to the company's share price, a variable which is influenced by a wide set of factors as well as managerial effort? A commonly expressed view is that the real motivation for implementing such compensation plans is to reduce the tax liability of the company and its executives, not to encourage managers to maximize the net worth of the firm. It is extremely difficult to disentangle incentive from tax motivations. The two approaches used in the literature are unable to provide a conclusive answer. An appeal to intuitive argument lends some support to the incentive hypothesis, but could not convince the unconvinced. Given this we must remain agnostic on the issue of whether tax rather than incentive considerations dominate the design of compensation contracts. Some searching questions, however, do need to be asked in view of the understandable fear of shareholders that the schemes used are designed purely to maximise managerial incomes net of tax.

Chapter 6

ALIGNING MANAGERIAL AND SHAREHOLDER INTERESTS: A SURVEY OF THE EMPIRICAL LITERATURE

6.1 INTRODUCTION

In recent years a popular view has been that executives are overpaid and that " compensation policies are irrational and ignore the needs of shareholders " (Murphy 1986, p.125). Underlying this argument is the belief that executive remuneration is based not on indicators of company performance, but on the self-serving interests of managers. Furthermore, it is claimed that there is little correlation between executive turnover and company performance: executives do not lose their jobs for poor performance. Typical of the prevailing views is Augustine's (1982) conclusion: There are many highly successful organisations in the United States. There are also many highly paid executives. The policy is not to intermingle the two.

These views are usually supported by anecdotal evidence to the effect that there is no concrete relationship between corporate performance and executive compensation. Loomis (1982), for example, reports compensation received by Rand V. Araskog, Chairman of I.T.T. of $1,150,000 in 1981 compared to the compensation received by Thomas L. Phillips, Chairman of Raytheon of $635,000. Yet Raytheon significantly outperformed I.T.T.. Such comparisons have their uses and may even be valuable in identifying abuse of the compensation system. However, such evidence does not constitute a compelling case against compensation policies.

The purpose of this chapter is to survey the literature which offers a formal analysis of the empirical relationship between executive compensation and performance.

At a conference held at the University of Rochester in 1984 entitled "Management Compensation and the Management Labour Market", a wide range of papers provided direct and indirect evidence on the incentive effects of executive compensation packages. The broad conclusions were as follows: executive compensation is positively related to share price performance; poor firm performance is associated with increased executive turnover; and the adoption of new short-term and long-term executive compensation plans and golden parachutes is associated with a positive share price reaction. Thus, according to Jensen and Zimmerman (1985) "these finding are interpreted as generally supporting the view that executive compensation packages help align manager's and shareholders' interests" (p.3). In what follows we will review the arguments presented at the conference (published in the Journal of Accounting and Economics, 7, 1985), since they serve to highlight the problems encountered in examining the incentive effects of executive compensation packages.

The last section in the chapter asks whether, in light of the empirical evidence reviewed, there are grounds for preferring any specific type of compensation package.

6.2 THE RELATION BETWEEN COMPENSATION AND CORPORATE PERFORMANCE

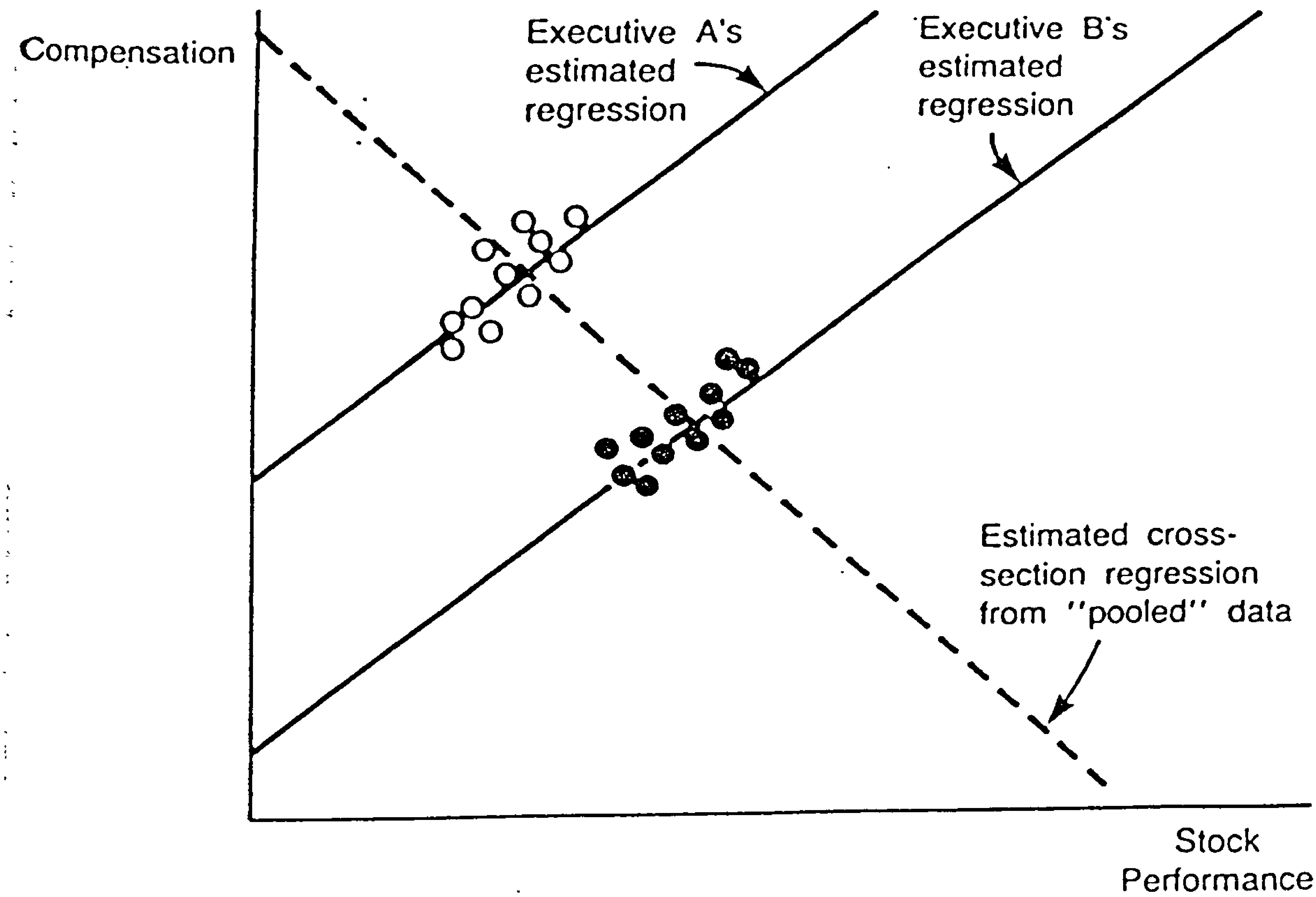
A simple test of the validity of the self-serving management hypothesis involves the sign of the relationship between executive compensation and corporate performance: a positive and significant relationship would lend support to the hypothesis that executives work in the interests of their shareholders, as opposed to the self-serving management alternative.

Efforts to identify such a relationship, however, have produced mixed results. Periodicals such as "Fortune" and "The Wall Street Journal" have repeatedly reported the apparent lack of correlation between managerial earnings and various measures of corporate performance (see, Loomis 1982, Drucker 1984). Other empirical studies such as McGuire, Chiu and Elbing (1962), Lewellen and Huntsman (1970), Masson (1971), Cosh (1975), Meeks and Whittington (1975), and Hirschey and Pappas (1981) have also produced results which are inconclusive.

A problem with such studies, however, is that they look at the level of executive compensation across companies at a particular point in time instead of considering the extent to which compensation varies over time with performance:

they use cross-section rather than time series data (see, Murphy 1985). Given that inter-firm and inter-industry differences are likely to be key variables in explaining differences in salary levels, a key issue in cross-section studies is whether adequate allowance has been made for such factors. Consider the omission of company size in a cross-section study on compensation and performance. Empirical evidence indicates a positive relationship between sales and compensation and a negative relationship between company size and the average rate of return on shares. In other words large companies have more generous compensation packages and on average worse share performance than small companies, who in turn have less generous compensation packages, but better share performance (Roberts, 1959, Agarwal, 1981) (see diagram 6.1). The use of cross-section data without consideration of company size is likely to suggest a spurious negative relationship between share performance and compensation.

FIGURE 6.1



Scatter plots and regression lines portraying the relationship between compensation and stock market performance for two hypothetical executives. Executive A, whose observations are denoted by O, is a highly paid executive in a large, low-performance firm. Executive B, whose observations are denoted by X, is a lower-paid executive in a small, high-performance firm. Separate time-series regressions (solid lines) indicated a positive relationship between compensation and performance. However, in a pooled cross-sectional regression (dashed line), which ignores the size differences between firms, the estimated relationship between compensation and performance is negative.
From figure 1, Murphy (1985), " Corporate Performance and Managerial Remuneration".

A second problem with many of the cross-section studies relates to the measure of compensation used (see Murphy 1985). Many studies have concentrated only on the most visible aspect of remuneration - the sum of salary and bonus - and omitted potentially performance-sensitive compensation components such as stock options, deferred compensation and stock awards. This is all the more important because in recent years salary and bonus has declined as a proportion of total compensation. Since shareholders are considered to be the principals in principal-agent theories, it seems reasonable to define performance in terms of the returns realised by the firm's common shareholders rather than in terms of accounting profits, which some studies have used (Cosh, 1975, Hirshey and Pappas, 1981, Llewellen and Huntsman, 1970, Masson, 1971, McGuire, Chiu and Elbing, 1962, and Meeks and Whittington, 1975). However, since this raw rate of return realised by shareholders depends not only on managerial productivity , but also on industry and market factors, it becomes necessary to modify this measure. The Industry-Relative performance index measures firm performance relative to other firms in the same industry; the Abnormal Performance Index measures firm performance relative to other firms in the same "risk class". Raw stock returns emerge as the best predictors of changes in aggregate measures of remuneration (salary + bonus and total compensation), industry relative rates of return as the best predictors of bonuses and deferred compensation.

Murphy

Murphy (1985) examines the relationship between firm performance and managerial pay using data that focuses on individual executives over time. He estimates the following relationship:

$$Comp_{it} = a_i + b\ Perform_{it} + e_{it} \qquad (1)$$

where $comp_{it}$ is the compensation received by executive i at time t and separate regressions are run for Salary, Bonus, Salary + Bonus, Deferred Compensation and Stock Options (Stock Options are valued using the Black-Scholes (1973) valuation formula); $Perform_{it}$ is the performance of the i^{th} executive's company at time t.

Murphy's tests involve several assumptions. First, it is assumed that, while an executive's compensation is likely to depend on certain individual specific factors such as age, education, training, ability, firm size and so on, these factors will be constant for each executive over time and will therefore be captured in the intercept term. This provides a potential source of omitted variable bias. Second, in order to overcome the problem of data deficiency (it would be pointless running 461 regressions for 461 executives with only an average of 10 observations for each executive), it is assumed that the sensitivity of pay to performance is the same for all executives (b_i=b) even though the intercept term varies across executives. It turns out, however, that such an assumption is only strictly valid for total compensation and bonus payments.

Murphy's time series results suggest a pronounced positive effect of performance on all aspects of compensation except stock options (see table 1). Murphy suggests that the negative relationship between performance and option values may arise because boards of directors are more likely to award options during periods of poor performance and will often reissue previously granted options at a lower exercise price. The latter may be the case, the former is certainly not, as evidenced by the dramatic increase in stock option awards in the first half of the 1980's period of buoyant profits and share prices. Nevertheless, Murphy's results certainly provide evidence against the popular view of self-serving management.

TABLE 6.1

TIME-SERIES AND CROSS-SECTIONAL REGRESSIONS OF COMPENSATION ON STOCK MARKET PERFORMANCE

PANEL A: TIME-SERIES ESTIMATES

Independent Variable	Dependent Variable (in logarithms)					
	TOTAL	SALARY	BONUS	SALARY + BONUS	DEFERRED	OPTION VALUE
Ln[Stock Index]	.2125 (18.6)	.0653 (5.5)	1.429 (8.3)	.1786 (20.4)	.4926 (4.9)	-.3600 (-2.1)
Position Dummies: Chairman	.2479 (10.3)	.2076 (7.9)	.5109 (1.4)	.2823 (15.4)	-.2388 (-1.1)	-1.018 (-2.9)
Position Dummies: Chief Exec	.5903 (28.5)	.4922 (21.4)	.7863 (2.4)	.5855 (37.0)	.4490 (2.4)	.0810 (0.3)
Position Dummies: President	.3668 (18.8)	.2929 (14.9)	.2796 (1.0)	.3598 (24.1)	.4238 (2.5)	.0 35 (0.3)
Sample Size	4500	2067	2067	4500	4500	4500
Number of Individual-Specific Intercepts	461	280	280	461	461	461
R^2	.798	.880	.551	.849	.704	.376
F	304.9	129.4	18.9	468.3	9.5	4.1

PANEL B: CROSS-SECTIONAL ESTIMATES

Independent Variable	Dependent Variable (in logarithms)					
	TOTAL	SALARY	BONUS	SALARY + BONUS	DEFERRED	OPTION VALUE
Ln[Stock Index]	-.0470 (-1.2)	-.1215 (-3.3)	.6895 (2.4)	-.1085 (-3.1)	1.721 (5.6)	-.1431 (-0.6)
Position Dummies: Chairman	-.0098 (-0.1)	.1926 (2.1)	-2.777 (-3.8)	.1049 (1.3)	-1.871 (-2.7)	-3.028 (-5.1)
Position Dummies: Chief Exec	.6947 (11.1)	.5758 (9.5)	.8800 (1.9)	.6287 (10.9)	1.265 (2.5)	.0778 (0.2)
Position Dummies: President	.7765 (8.2)	.5397 (5.5)	.4617 (0.6)	.6973 (8.0)	-.1013 (-0.1)	1.436 (2.2)
Sample Size	461	280	280	461	461	46
Number of Individual-Specific Intercepts	--	--	--	--	--	--
R^2	.294	.312	.089	.293	.096	.044
F	47.4	31.2	6.7	47.2	12.1	7.8

Estimated coefficients from time-series regression models using data from the 1964-1981 sample of 461 executives in 72 manufacturing corporations. The performance variable, Stock Index, is based on the rate of return realized by shareholders. The t-statistic is indicated in parentheses. F-statistic tests joint significance of ln(Stock Index) and the three position dummies. An F-statistic greater than 3.3 is significant at the 1 percent level.
From table 5, Murphy (1985), "Corporate Performance and Managerial Remuneration".

Coughlan and Schmidt

Coughlan and Schmidt (1985) overcome the problem of inter-firm and inter-industry differences in the pay-performance relationship by regressing the rate of change in compensation on abnormal stock returns. Their investigation, however, involves only salary plus bonus in order to avoid the systematic relationship between other components of remuneration and company performance. Their rationale for doing so is that: "because these other components explicitly relate compensation to stock performance, a significant relation between salary and bonus and stock price performance is not necessary for a conclusion that board of directors construct executive compensation plans that increase shareholder wealth. A significant positive relation between salary plus bonus and stock price performance, however, strengthens [the] argument that board of directors purposefully set discretionary pay components to induce the executive to increase shareholder wealth".(Coughlan & Schmidt 1985, p.54)

The regression model is :

$$\mathrm{Ln}\left[\frac{(\text{deflated Salary + Bonus})_{i,t}}{(\text{deflated Salary + Bonus})_{i,t-1}}\right] = \alpha + \beta(\text{Ab. Stock Returns})_{it} + e_{it}$$

which is estimated using survey data on chief executive officers (CEO's) in "Forbes" Magazine for 1978, 1979 and

1980. The data set is also divided into two groups: group A contains C.E.O.'s who are younger than 64 years of age and group B includes all C.E.O.'s who are at least 64 years old. This is to avoid problems of mandatory retirement with its associated compensation effects.

The coefficient (β) on Abnormal Stock returns is positive and significant in all regressions for the under 64 age group (see table 2). The results are mixed for 64 years plus group, reflecting probably "the effect of retirement-related events on changes in compensation" (Coughlan and Schmidt, 1985, p.55).

Table 2

	Panel A: Age < 64				
	t = 1978 (1)	t = 1979 (2)	t = 1980 (3)	Combined sample (4)	(5)
Constant	0.015	0.017	0.003	0.012	0.011
	(1.13)	(1.34)	(0.21)	(1.59)	(1.42)
Cumulative residual from market model for year t	0.158	0.119	0.144	0.137	0.136
	(2.73)	(3.17)	(2.97)	(5.22)	(5.12)
Deflated sales growth in year t	-	-	-	-	0.017
					(0.27)
Sample size	158	165	159	482	482
Number of firms	158	165	159	218	218
R-squared	0.046	0.058	0.053	0.054	0.054
F-ratio	7.46	10.08	8.82	27.27	13.64
Prob [>F]	0.007	0.0018	0.0034	0.0001	0.0001

	Panel B: Age > 63				
	t = 1978 (1)	t = 1979 (2)	t = 1980 (3)	Combined sample (4)	(5)
Constant	0.014	0.042	-0.055	0.007	-0.001
	(0.50)	(1.26)	(-1.43)	(0.36)	(-0.06)
Cumulative residual from market model for year t	0.06	0.157	0.022	0.122	0.096
	(0.64)	(1.38)	(0.18)	(1.99)	(1.46)
Deflated sales growth in year t	-	-	-	-	0.252
					(1.10)
Sample size	37	41	37	115	115
Number of firms	37	41	37	58	58
R-squared	0.012	0.047	0.001	0.034	0.044
F-ratio	0.41	1.91	0.03	3.95	2.58
Prob [>F]	0.5282	0.1748	0.8576	0.0493	0.0802

Estimated coefficients from regression of the deflated percentage change in salary plus bonus from year (t-1) to t on the deflated cumulative residual from the market model in year t and deflated percentage sales growth from year (t-1) to year t, for 249 firms in the period 1978-1980. The regressions are numbered 1 through 5. The "Combined sample" regressions use pooled data from the three subsamples where t equals 1978,1979, and 1980. 218 firms are represented in the sample of CEO's at least 64 years old. 249 distinct firms are considered in total (since a CEO of one firm may become 64 years old in our sample period, and thus some firms appear in both age categories). The t-statistics are in parentheses.
From table 3, Coughlan and Schmidt (1985), "Executive Compensation, Management Turnover, and Firm Performance".

Benston

Benston (1985) investigates the self-serving management hypothesis by examining the personal financial gains and losses achieved and absorbed by senior managers who hold a significant amount of shares in their employing company, and so gain or lose personal wealth in line with other shareholders. Changes in wealth resulting from changes in the value of stock holdings amount to as much as five times the value of the other forms of remuneration. This corroborates the finding of Lewellen (1971), and is inconsistent with the self-serving management hypothesis: "unless one subscribes to a rather peculiar version of this hypothesis - i.e., that such is the desire to govern huge groups that a manager is willing to make a monetary loss for this psychic gain", Benston (1985, p.82). This lends support to the notion that executives are rewarded/punished for taking action that benefits/harms their shareholders.

Some Difficulties

There are several fundamental difficulties with the empirical studies discussed above (see Kerr and Bettis, 1987). First, "all three studies erroneously measure a CEO's compensation as the sum of salary payments and bonus awards distributed in a given year" (p.648). The aim of including the salary element is to reflect the extent of experience and performance required to fulfil an executive function at a particular level in the organisation. In order to align effectively the salary component to the performance value of the firm it would need to be renegotiated on the basis of past performance, whereas bonus awards are designed to compensate the executive on the basis of recent (year-end (t)) corporate performance. Both Benston (1985) and Coughlan and Schmidt (1985) lump salary and bonus into a single figure thus obscuring the performance-reward relationship.

Second, the empirical studies involve an inconsistent definition of stock performance. Benston (1985) used raw stock returns; Murphy (1985) used raw returns and returns adjusted for risk classes; and Coughlan and Schmidt (1985) used returns adjusted for overall market performance. The last two studies used "definitions of abnormal returns [which] are based on entirely different constructs and are virtually nonconparable" (Kerr and Bettis 1987, p.648). This inconsistency is highlighted by the contrast between the findings: in Murphy (1985) there is a positive relationship between performance and compensation; Benston (1985) has no relationship; and Coughlan and Schmidt (1985) established only a weak relationship between annual compensation and firm performance.

A third major problem concerns the relationship between executive compensation and firm size. The evidence (see for example Fox 1982) indicates that the compensation of top management is positively related to firm size. High compensation for the management of large firms may be necessary because managing those firms involves more complex and demanding tasks. Organisations will try to maintain pay differentials between levels of management: therefore top executives in larger firms will receive higher compensation as the number of layers of bureaucracy increase, Simon (1957). This is consistent with both "Span of Control" theory and the strong correlation between firm size and the number of executive levels, Blau (1970), Child (1973).

Both Murphy (1985) and Coughlan & Schmidt (1985), report a positive relation between changes in executive compensation and the real rate of growth of firm sales. An explanation of this finding can be given in terms of the following argument. It is not appropriate to base remuneration exclusively on stock performance because of the existence of windfall gains and losses caused by factors outside the executive's control. The inclusion of sales growth as an additional determinant of executive compensation allows firms to reward executives on the basis of a perhaps less imperfect measure of managerial effort. This line of reasoning finds some support in the empirical findings of Coughlan and Schmidt (1985), where both stock price performance and sales growth have significant effects on executive compensation.

6.3 THE RELATION BETWEEN EXECUTIVE TURNOVER AND CORPORATE PERFORMANCE

The extent to which executive compensation contracts overcome the principal-agent dilemma may be examined further by investigating the relationship between executive turnover and corporate performance. If boards of directors discipline managers for actions or results that reduce shareholder utility, stock price performance can trigger changes in management. The expectation is that poor performance will increase the probability that top managers lose their jobs.

Attempts to identify such a relationship empirically, however, are likely to be complicated by several factors. There exist many possible reasons for a change in top management : successful executives may move to more lucrative positions in other firms; normal retirement; death, and so on. Furthermore, poor performance can arise from a variety of causes, many of which do not reflect incompetence on the part of top management and, therefore, should not warrant dismissal. Moreover, even if a board of directors is convinced that an executive is in some way responsible for poor stock performance, it may not effect a change in management within the performance year, because replacing an executive requires considerable deliberation.

These problems aside, some negative relationship between executive turnover and corporate performance should still exist. Indeed, both Coughlan & Schmidt (1985) and Benston

(1985) report results consistent with this hypothesis. In a logit regression using executive turnover as the discrete dependent variable, Coughlan & Schmidt find that an executive whose firm is ranked in the bottom one percent of the distribution of abnormal stock returns is seven times more likely to leave the firm than an executive employed by a firm in the top percentile (see Table 3). In a similar regression for executives aged 64 and over, the relationship is insignificant, reflecting problems of mandatory retirement. Benston (1985) compares the geometric mean of share price returns in the year an executive leaves his present employment and the two previous years with similarly measured returns for the other conglomerates in his sample. He found that executives tend to leave after their shareholders experience significantly greater losses than those experienced in the conglomerates where the senior management did not change - a result consistent with the hypothesis that poor performance increases the likelihood that top management will forfeit their jobs.

Table 3

Percentile rank in stock return distribution	CUMABN Cumulative residual for year t	Probability of CEO turnover
1%	-0.807	0.213
10%	-0.377	0.126
20%	-0.231	0.105
50%	0.000	0.077
80%	0.209	0.058
90%	0.317	0.050
99%	0.655	0.031

Probability of management change by stock price performance for AGE = 57 and a zero percentage difference between actual and estimated compensation in year t [estimated probabilities are obtained from logit regressions with AGE , 64]. For example, a 57-year-old CEO who is paid what is predicted by the model and who is in the bottom first percentile of the stock return distribution in the sample faces a 21.3 percent chance of leaving the company in the next year.
From table 5, Coughlan and Schmidt (1985), "Executive Compensation, Management Turnover, and Firm Performance".

6.4 STOCK PRICE REACTION TO EXECUTIVE CONTRACT CHANGES

The studies discussed in section II of this chapter provide evidence that compensation is contingent on performance. It is, however, very difficult to infer from these studies the direction of causality : is the change in firm performance caused by changes in management compensation or vice-versa?

Two major studies in this area have produced evidence which appears to support the hypothesis that causality runs from changes in compensation plans to firm performance. Brickley, Bhagat & Lease(1985) and Tehranian & Waegelain (1985) both examine stock price performance at the time firms adopt management incentive plans, the former dealing with 175 long-term plans adopted between 1979 - 1982, the latter with 42 short-term plans adopted between 1971 - 1980. The results suggest a positive stock price reaction to incentive plan adoption (see Table 4). For the 83 firms for whom suitable data was available, Brickley et al estimate an average abnormal stock performance of plus 2.4% in the period from the initial approval of the board of directors through to the day after Stock Exchange Commission (S.E.C.) approval of the plans. They also report a plus 1% abnormal stock performance during the period of two days from the S.E.C. stamp date to the subsequent shareholder's meeting. Tehranian & Waegelain find stronger evidence of abnormal performance during the period of seven months prior to the proxy statement date. They report a cumulative abnormal stock price performance of plus 22.3%. A plausible reason for the strength of this result compared to that of Brickley et al, is that the former considered only new plans, whereas the latter also considered changes in existing plans which are arguably likely to have a smaller stock price effect.

Table 4

Paper	Sample size	Observation period	Cumulative mean abnormal stock price performance	Z-value
Brickley,Bhagat and Lease	83	Board meeting date through day after receipt of proxy statement by the Securities and Exchange Commission (mean length = 58.4 trading days)	2.4%	2.18
		Two days after the SEC stamp date through the shareholders meeting date (mean length = 22.3 trading days)	1.0%	1.09
Tehranian and Waegelein	42	Months -3 through 0 relative to proxy statement date	11.3%	3.03
		Months -7 though -4 relative to proxy statement date	11.0%	4.32

Summary of stock price performance around the time of management incentive plan adoption.
From table 5, Brickley, Bhagat and Lease (1985). "The Impact of Long-range Managerial Compensation Plans on Shareholder Wealth".
From table 1, Tehranian and Waegelein (1985). "Market Reaction to Short-term Executive Compensation Plan Adoption".

There are, however, problems of interpretation with these two studies : do the results really lend support to the hypothesis that executive compensation contracts help align managerial and shareholder interests? There are at least three reasons why the adoption or modification of an incentive plan may be associated with a positive reaction in the share price. The first is that compensation plans have incentive effects and so help produce a symbiosis between managerial and shareholder interests. In a second scenario, however, managers are instrumental in instigating the introduction of compensation plans when they believe that the share price is going to increase for reasons which have nothing to do with incentive effects: they may, for example, have obtained some kind of insider knowledge to the effect that share price is undervalued and compensation schemes are used as a device to signal this to the market. This implies that compensation packages do not improve performance but rather the reverse: improved performance encourages the adoption of compensation plans, thus increasing pay, with no corresponding increase in managerial effort - managers hang on the coat-tails of successful companies. In a third scenario the positive share price effect is associated more with tax than incentive effects. In our discussion in the preceding chapter we attempted unsuccessfully to distinguish between tax and incentive effects, although it is by no means clear that tax effects can explain the whole of the share price reaction : one investigator, for example, felt "uneasy about attributing a large positive stock price effect solely to tax effects" because not all plans are tax advantageous, and suggests that "better data would allow us to partition the samples according to the expected sign of tax effects, and to estimate a priori the magnitudes of the implied stock price reaction" (Warner 1985, p.147).

In an attempt to discriminate between the incentive and signalling hypotheses, Bhagat, Brickley and Lease (1985) examined the stock market reaction to stock purchase plans. These plans fall into compensation categories which Miller & Scholes (1982) argue do not have tax advantages and may therefore be assumed to have been adopted for either incentive or signalling reasons. Their results suggest that compensation schemes have a positive effect on shareholder wealth for reasons other than tax reduction. They report a cumulative return on the firm's common stock of plus 5.47% between days -20 and +20 relative to the announcement of the plans in proxy statements.

Table 5

Event day	Mean return (%)	Cumulative return (%)
-20	0.09	0.09
-19	-0.26	-0.17
-18	-0.38	-0.55
-17	-0.72	-1.27
-16	-0.51	-1.78
-15	-0.06	-1.84
-14	-0.45	-2.29
-13	-0.23	-2.52
-12	0.12	-2.40
-11	1.16	-1.24
-10	0.46	-0.75
-9	0.67	-0.09
-8	0.13	0.05
-7	-0.07	-0.03
-6	0.41	0.38
-5	0.34	0.72
-4	0.59	1.31
-3	0.32	1.63
-2	-0.83	0.80
-1	0.53	1.33
0	1.81	3.13
1	1.62	4.75
2	-0.01	4.74
3	-0.04	4.70
4	-0.23	4.47
5	-0.74	3.73
6	-1.04	2.69
7	0.39	3.08
8	0.67	3.75
9	0.64	4.39
10	-0.18	4.21
11	0.43	4.64
12	0.24	4.88
13	0.42	4.45
14	0.67	5.12
15	-0.05	5.07
16	-0.84	4.23
17	0.75	4.98
18	0.63	5.61
19	0.01	5.62
20	-0.14	5.47

Common stock rates of return over 41 - trading-day period around the proxy mailing date for the 19 stock purchase plans over the period 1970 through 1982. From table 4, Bhagat, Brickley and Lease (1985). "Incentive Effects of Stock Purchase Plans".

This positive market reaction to stock purchase plans could arise from incentive or signalling reasons. Once again, however, distinguishing between the two explanations is difficult because the major predictions of each hypothesis are virtually equivalent. Nevertheless, Bhagat, Brickely and Lease argue that three types of evidence provide "at least weak support that incentive effects are present in stock purchase plans above and beyond any pure signalling effects" (Bhagat et al, 1985, p.207). The first concerns the stated motive for the adoption of compensation plans: they find that in 17 out of the 19 cases examined the board stated that the plan adopted was designed to improve managerial incentives. The second type of evidence involves the stock purchase plans of privately-held firms. While a privately-held firm may wish to signal profit potential to its creditors, it is unlikely to wish to transmit such a signal to the stock market in general. The finding is that stock purchase plans exist in 21.2% of their sample of privately-held companies: the mere existence of such a sizeable proportion is seen as providing evidence of incentive effects, given the relative infrequency of stock purchase plans among listed companies. The third type of evidence is derived from a re-estimation of Cone's (1984) model of financial signalling: the Cone model predicts that management will only find it profitable to signal after a period of poor performance when they are in danger of losing their job. The finding is that there is no significant deterioration in performance evident in the period prior to the announcement of the plans. In view of Tehranian and Waegelein's observation that firms tend to adopt plans after a period of good performance, however, this finding does not constitute decisive evidence of the presence of incentive effects.

Two Remaining Problems

There are at least two further problems which arise in testing stock market reaction to the adoption of compensation schemes. A first is that the introduction of compensation plans is often closely preceeded or followed by the release of information regarding profits and basic salaries : this raises the distinct possibility that improved performance may be attributed to incentive plans when it is in fact due to the announcement of increased profits or basic salaries. The papers discussed above do not address this problem. Controlling for such factors is clearly important to our understanding of the extent to which higher stock prices lead to plan adoption or vice-versa.

A second problem concerns the type of compensation package adopted. If incentive effects are important, we would expect that certain packages, those which have a longer time dimension for example, should dominate others in the sense that they have, and are perceived to have, more potent effects on incentives. Brickley, Bhagat and Lease (1985), however, find no appreciable difference in stock market reaction to different packages. The absence of any noticeable difference in share price reaction to different packages obviously raises doubt as to the importance of incentive effects.

6.5 STRATEGIC DETERMINANTS OF EXECUTIVE COMPENSATION PACKAGES

In the literature dealt with so far in this chapter no attempt is made to explain the precise characteristics of executive compensation contracts. It is implicitly assumed that a compensation scheme which is "optimal" in view of the firm's environment has been implemented. There is no discussion of why a specific scheme might be the best motivational device for a given environment, or of why the specifications of "optimal" contracts might differ across firms and industries.

Berg (1969, 1973) suggests that differences in the design of reward systems reflect differences in the level of autonomy granted to the divisions of conglomerates or large diversified firms. Subsequent research (Lorsch & Allen, 1973; Pitts, 1974; Salter, 1973) revealed that the more diversified a company, the higher the probability that managers would be rewarded on the basis of objective or quantitative measures of performance rather than on the basis of subjective or qualitative criteria. Furthermore, the quantitative measures of performance used tend to be based on the results of the operating unit and not the corporation as a whole. The key factor underlying these variations was the degree of autonomy : greater diversification meant greater divisional independence, which necessitated different reward strategies. These studies, however, consider only two diversification strategies at a time.

The most comprehensive study in this area is that of Kerr (1985), who deals with a wide range of diversification strategies and reward systems. He classifies firms according to two stylisations of diversification: Rumelt's (1974, 1977) typology of diversification; and the process by which diversification is achieved (Pitts, 1974; Leontiades, 1980). The Rumelt classification deals with product type (single-product, dominant-product, related-product, unrelated-product), and with the pattern of linkages between units (vertical, constrained, linked, multi-business, portfolio). A major problem with this classification scheme is that it is essentially static. Leontiades (1980) attempts to deal with this problem by distinguishing between steady-state and evolutionary strategies, a distinction that rests on differences in the process of diversification. Evolutionary firms are externally oriented, growing primarily through acquisitive diversification, and are diversification, and are active prospectors of new markets. In contrast steady-state firms are internally orientated, growing through increasing penetration of existing markets, or by way of internally generated diversification.

The Kerr classification of compensation schemes was obtained by interview-derived information on 35 aspects of reward systems (see Table 6). From this information Kerr distinguished three basic types of reward system. Companies of the first type employ a "hierarchy-based" system : evaluation depends on the perceptions and evaluations of superiors, the distribution of rewards being based on the position in the hierarchy. Performance is defined in terms of subjective, qualitative measures; potential bonuses are determined by corporate performance and position within the hierarchy; salary increments are based on performance and length of tenure; share awards are made only to those in executive grades. Companies in the second type employ a "performance-based" reward system: performance and rewards are highly linked in these firms. Bonuses are based almost entirely on performance of the manager's operational unit; salary increments and share awards are determined on the basis of objective, quantitative measures of performance. Finally, Kerr identifies a "mixed" system which falls between the two polar extremes: for some purposes firms evaluate performance objectively, for other purposes subjective means of evaluation are employed. (For a comprehensive description of each cluster see Kerr (1985)).

Table 6

1. Quantitative vs. qualitative performance criteria
2. Subjective vs. objective weighting of performance criteria
3. Linkage between specific criteria and specific rewards
4. Current vs. future-oriented performance criteria
5. Operating vs. financial performance criteria
6. Performance defined by strategic mission
7. Subjective vs. objective performance evaluation
8. Who carries out evaluation process?
9. Time frame of evaluation process
10. Frequency of formal feedback sessions
11. Dependency on superior-subordinate interaction
13. Evaluative vs. developmental emphasis in feedback process
14. Basis for inclusion in bonus plan
15. Major determinants of bonus amount (in order of importance)
16. Bonus determination process (objectivity)
17. Potential range of bonus as % of salary
18. Basis of bonus pool (corporate vs. division performance)
19. Major determinants of salary increase amount (in order of importance)
20. Determination of salary increase amount (objectivity)
21. Potential range of salary increase as a % of salary
22. Actual range of increases in use as % of salary
23. Basis for inclusion in stock plan(s)
24. Major determinants of potential stock award amounts
25. Major determinants of actual stock award amounts (in order of importance)
26. Determination of stock award amounts (objectivity)
27. Potential range of stock award as a % of salary
28. Time frame for payout of stock awards
29. Degree of enforcement of perquisite system
30. Emphasis on status differences as expressed in the perquisite system
31. Primary motive for promotion or transfer
32. Primary determinants of promotion or transfer
33. General frequency of promotion or transfer
34. Promotion norm 1: promotion from within
35. Promotion norm 2: cross-divisional or cross-functional movement

Variables Examined in Stuctured Interviews
From table 2, Kerr (1985), "Diversification Strategies and Managerial Rewards : An Empirical Study".

The central conclusion to emerge from Kerr's analysis was that the difference in reward systems could not be explained by reference to Rumelt's typology of diversification or pattern of linkage, but could be explained by the steady-state / evolutionary classification of diversification used by Leontiades (See Table 7). "Hierarchy-based" reward systems were employed primarily by firms whose expansion paths involved growth in current areas of activity or through internally generated diversification ie. in firms of the "steady-state" types. "Performance-based" reward systems were used by firms pursuing growth through acquisitions and mergers, ie. in firms of the "evolutionary" type. "Mixed" reward systems were used by two types of firm: the first were in transition state regarding level of diversification; the second were attempting to manage a highly diversified set of activities. Kerr (1985) concludes that "the process by which diversification had been achieved was a greater influence on the design of managerial reward systems than was the cumulative extent of diversification at a point in time" (p.155).

Table 7

Cluster A (Hierarchy-based)		Cluster B (Performance-based)		Cluster C (Mixed-System)	
Allied	SGL/VER/SS	Home	DOM/LIK/EV	Alaska	DOM/PFO/EV
Intern.	SGL/VER/SS	Jones	REL/CON/SS	Smith	DOM/LINK/EV
Kelly	DON/CON/SS	Alpha	UNR/MUL/EV	Most	DOM/CON/SS
NaChem	REL/CON/SS	Consol	UNR/MUL/EV	Kasper	UNR/MUL/SS
World	REL/LNK/SS	General	UNR/MUL/EV	PMI	UNR/MUL/SS
Best	REL/CON/SS	Leisur	UNR/MUL/EV		

Companies by Cluster and Strategy Clasifications
From table 5, Kerr (1985), Diversification Strategies and Managerial Rewards : An Empirical Study

A further distinction is drawn by Gomez-Mejia, Tosi and Hinkin (1987) and concerns the distinction between owner-controlled and management-controlled firms. The central argument is that executive pay is more responsive to performance in owner-controlled firms with a dominant stockholder. This has important implications for the studies analysed in section II of this chapter, suggesting that the structure of ownership is an important determinant of the relationship between pay and performance. When ownership is spread across a wide number of stockholders, power of shareholders to control managers can become diluted. Consequently, managers can have more freedom to place their own interests above those of shareholders when designing compensation systems. Gomez-Mejia et al present evidence that management-controlled firms are more likely to display risk-aversion and use scale as a major determinant of managerial compensation, whereas the compensation-performance link is stronger in companies with dominant stockholders.

They established the importance of ownership structure by analysing survey data from Business Week (1980-83) on 71 American firms, randomly selected from the largest 400 manufacturing firms for the years 1979 to 1982. Only performance was statistically significant as a explanatory variable for the compensation measures in the "owner - controlled" group. In the "management-controlled" group, on the other hand, sales was the only significant explanatory variable for base salaries, and the main source of variation in bonuses and total compensation - although performance did have a significant effect on long-term compensation.

6.6 CONCLUSION

The first attempts at a comprehensive empirical assessment of the relationship between corporate performance and managerial remuneration packages have emerged in recent years. Taken at face value, the studies suggest a positive and significant relationship between pay and performance; a negative relationship between performance and executive turnover; a positive stock market reaction to the announcement of executive contract changes; and that diversification strategies and ownership structure are important determinants of compensation packages; and so on.

Virtually all the studies, however, are plagued by difficulties of interpretation. A central problem here is the issue of causality: do the compensation packages employed provide the appropriate managerial incentives for greater effort, and thus generate an improvement in corporate performance? ; or does causality work in the opposite direction, improvements in corporate performance arising from reasons independent of managerial effort leading self-serving managers to arrogate higher levels of compensation to themselves? The available empirical evidence does not permit a conclusive answer to the question. Like sighting of the Yeti, incentive effects arising from managerial contracts have been reported, but remain unconfirmed.

PART III. EXTERNAL ASPECTS : MARKET STRATEGY

Chapter 7

THE STRUCTURE - CONDUCT - PERFORMANCE APPROACH

7.1 INTRODUCTION

The way in which the external environment affects the competitiveness of a business has been the chief concern of structure - conduct - performance (SCP) models. The essence of this approach is to establish causal links between structure, conduct and performance: how do different structural characteristics, determined by exogenous basic conditions, lead to the adoption of different strategies which can allow a firm to gain a competitive edge over its rivals?

The SCP approach has been enormously influential in the analysis of industry throughout the world, probably because it was arguably the first formal model to integrate four separate disciplines - organisational theory, industrial economics, business strategy and finance - yet requires no more than the standard devices of neoclassical microeconomic theory. Furthermore, policy prescriptions are arrived at using the only widely acceptable criteria, the Pareto optimality criteria.

Nevertheless, the SCP approach has received considerable criticism. In particular, people have suggested that the relationships between structure, conduct and performance are more complex than originally envisaged and others have disputed the relevance of neoclassical microeconomics to the study of industry. The basic objection is that the SCP approach gives too limited a perspective on the operations of markets. These criticisms are certainly justified insofar as they relate to the simplistic exposition of the approach given most attention in the literature. In defense, it could be said that the SCP approach has provided a framework within which to examine more complicated relationships.

The rest of this chapter will examine the basic relationships underlying the SCP paradigm and the evolution of this approach, the criticisms of this framework and how the traditional exposition can be extended.

7.2. THE STRUCTURE - CONDUCT - PERFORMANCE PARADIGM

The SCP paradigm suggests that exogenous basic conditions determine market structure and that there is a unidirectional flow of causation from structure via conduct to performance.

The linkage between structure, conduct and performance turns to the question of "matching" the structural characteristics against models of perfect competition, monopoly, monopolistic competition and oligopoly. The broad descriptive model of these relationships was first conceived by Edward S. Mason at Harvard during the 1930's and has been extended by numerous scholars (Bain, 1951, 1956, 1968; Bloch, 1974; Brozen, 1970, 1971; Caves, 1972; Clark, 1961; Comanor and Wilson, 1974; Demsetz, 1973, 1974; Mann, 1966; Qualls, 1974; Peltzman, 1977; Schmalensee, 1972; Weiss, 1974). Mason's seminal work provided a challenge to those interested in problems of public policy. He argued that "if economics is to put itself in a position to contribute to the formulation of public policy, ... it must conceive the monopoly problem in a more intensive way than is at present customary. It is not enough to find evidence of the existence of market controls, nor is it sufficient to conduct purely analytical and descriptive studies of various types of control situations. While this is important, the formulation of public policy requires a distinction between situations and practices which are in the public interest and those which are not .... A further study of different types of industrial markets and business practices and of the effects on prices, outputs, investment and employment designed to indicate means of distinguishing between socially desirable and undesirable situations ... is ... the only way in which economics can contribute directly to the shaping of public policy." (Mason 1937, p.49)

The policy implications, which need not detain us here, "sparked off new efforts to understand and analyse economic activities that did not conform very well to the models of the market then available and to develop a larger body of factual knowledge about industry and markets" (McKie 1970, p.3). The "different types of market" incorporated in Mason's original research came to be classified within the general heading of market structure; "business practices" were specified under the caption market conduct; and the "effect on price, outputs" and so forth, were placed under the umbrella of market performance.

The simplest version of the SCP framework is revealed in the following chart (Scherer 1980, p.4).

BASIC CONDITIONS

Supply	Demand
Raw Materials	Price Elasticity
Technology	Substitutes
Unionisation	Rate of Growth
Product Durability	Cyclical and
Value / Weight	Seasonal Method
Business Attitudes	Purchase Method
Public Policy	Marketing Type

MARKET STRUCTURE
Number of Sellers and Buyers
Product Differentiation
Barriers to Entry
Cost Structure
Vertical Integration
Conglomerateness

CONDUCT
Price Behaviour
Product Strategy and Advertising
Research and Innovation
Plant Investment
Legal Tactics

PERFORMANCE
Production and Allocation Efficiency
Technical Full Employment
Equity

Market Structure is determined by the basic conditions prevailing in the environment in which the firm is to be located. On the supply-side, basic conditions include the location and ownership of essential raw materials; the character of the available technology; the degree of work force unionisation; the durability of the product; the time pattern of production (whether goods are produced to order or delivered from inventory); the legal, ethical and political framework within which business activity takes place; and so on. On the demand-side, basic conditions include price elasticity of demand; availability of (and cross elasticity of demand for) substitutes; the trend of market growth; cyclical and seasonal aspects; purchasing habits of customers; and marketing characteristics of the product sold.

These characteristics will determine the number and size distribution of sellers and buyers (ie. the degree of concentration); the extent of differentiation among competing products; the presence or absence of barriers to entry facing potential entrants; the degree to which firms are vertically integrated from raw material production to retail distribution.

In turn the external structure of the environment in which the firm operates will influence the choice of corporate strategies. Conventionally one looks at: how price is set; the way in which the volume, quality and the range of products are determined; advertising and marketing strategies; research and development planning and implementation; and legal tactics.

The choice of strategy will ultimately determine the performance of the company. Performance is obviously an elusive concept and depends in part on the task in hand. A typical list of performance measures includes : allocative efficiency, X-efficiency, rate of return on equity, employment creation, technological progressiveness and quality of output. For our purposes, to assess firm competitiveness, we would look at the divergence of the firm's rate of profit from the industry average.

Even this cursory glimpse of the SCP framework reveals the potential richness of the approach. However, much of the early literature confined itself to a very limited number of variables, and was firmly grounded in the neoclassical tradition.

7.3 MARKET STRUCTURE

The structure of a market can be described by considering the number of firms, the extent of product differentiation, entry conditions, and the degree of integration. Typically, the only structural characteristic considered, or at least the one to receive the greatest attention, has been the degree of concentration with respect to sellers. Concentration of sellers concerns the extent to which an economic activity is confined to a few large firms. Where a single firm has obtained a major share of the total market, it is faced by a downward sloping demand curve, opening up the possibility of acquiring above normal profits by charging the price for a specific good or service which equates marginal revenue and marginal cost but lies above average cost. The smaller the number of firms and / or the more disparate their sizes, the more concentrated and less competitive the market. "The hypothesis in brief is that the average profit rate of firms in oligopolistic industries of a high concentration will tend to be significantly larger than that of firms in less concentrated oligopolies or in industries of atomistic structure" (Bain 1951, p.294).

A simple way of expressing this hypothesis is by a relationship of the form

$$r = f(C,e) \qquad f' > 0$$

where $r = \pi / K$, π being profit and K a measure of capital. C is a measure of concentration, which will be discussed in the next sub-section; and e is an error term covering a host of unmeasured and or random influences. An interesting feature of this hypothesis, the structure-performance relationship, is the deliberate and significant omission of the "conduct" term. If C is a benchmark measure of concentration relevant to some welfare ideal, then $r^{\sim}=f(C)^{\sim}$

is a benchmark rate of profit. Typically $0 < C < 1$ is a property of a concentration index, and $C = 0$ being the atomistic competition value of the index, and $C = 1$ being its value under monopoly. Thus $r^{\sim} = f(0)$ is a possibility, implying that $f(0) = 0$. The argument embodied in the equation $r = f(C)$ is as follows. First, concentration causally determines profitability. This is expressed by choosing r as the dependent variable and C as the independent variable. Second, concentration above the benchmark level ($C > C^{\sim}$) raises profitability above the benchmark level ($r > r^{\sim}$). Formally, profitability is increasing in concentration ($dr/dC > 0$).

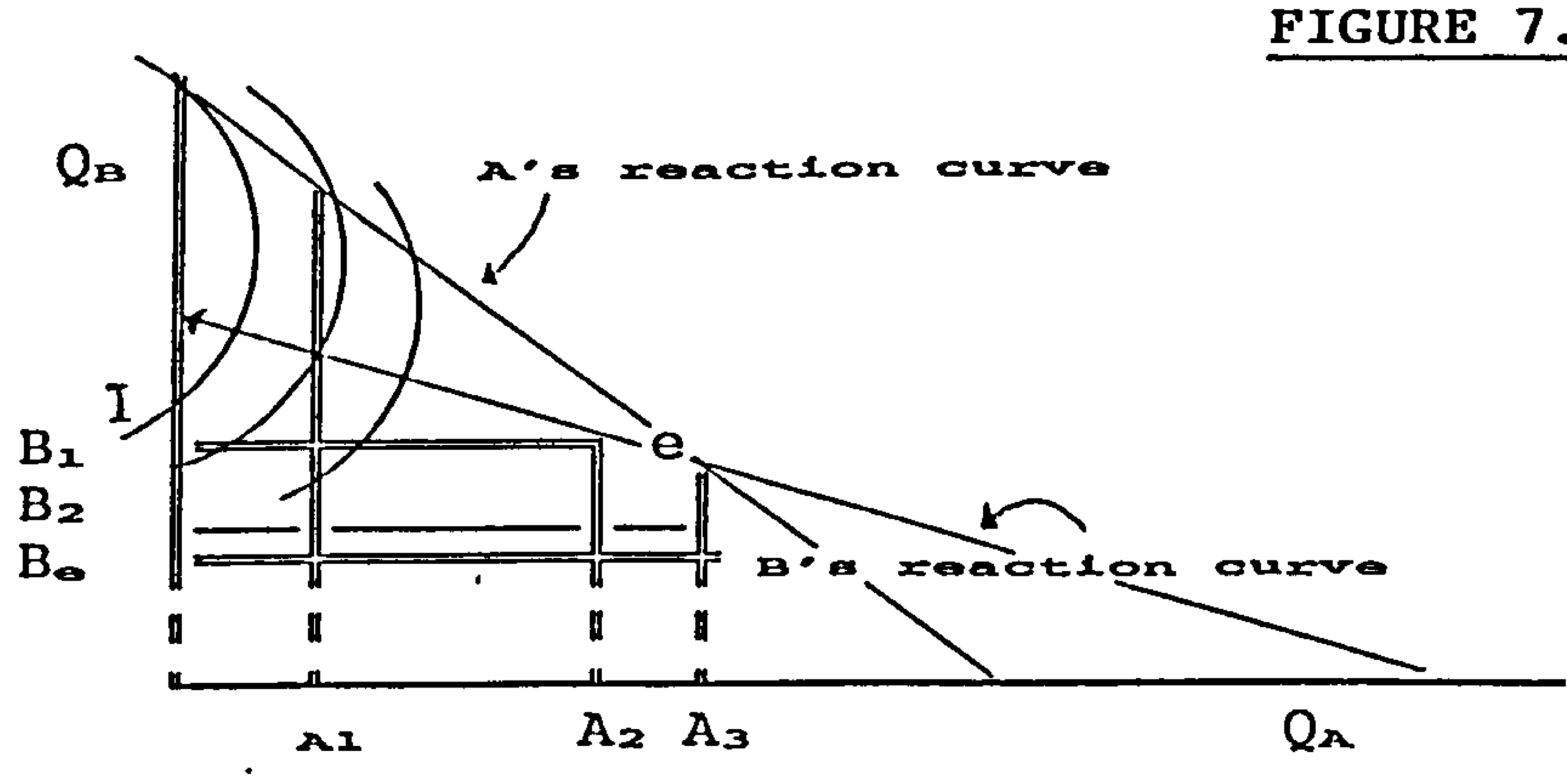
7.4 CONDUCT

No account has been taken in this simple framework however, of conduct. It was left to Cowling (1976) and Scherer (1980) to argue that explicit behavioural assumptions should be adopted. In principle a multitude of strategies are open to a firm, but more often than not , conduct is assumed to take a simple form such as profit maximisation. A number of profit maximisation models have been examined in line with standard neoclassical analysis. In what follows we shall discuss a few such models, which fall naturally into two categories : one in which firms do not collude; and the other in which they do.

Both the Cournot and Stackelberg models fall into the former category and have much in common. Both apply to a situation in which firms play a game in which they must choose the level of output to produce (a variant on the game would be to choose the price level, as in the Bertrand model). The payoffs from the game are profits, which depend upon the choice of strategy of the other players.

The Cournot model assumes that each firm acts on the assumption that its competitors will not change their output decision in response to the other firms choice of output. Thus they choose their output level so as to maximise profits. Equilibrium is achieved when no single player can improve his payoff by adopting a different strategy given the choice of strategy of his rivals. In the case of non-collusive duopoly this may be depicted in the following diagram.

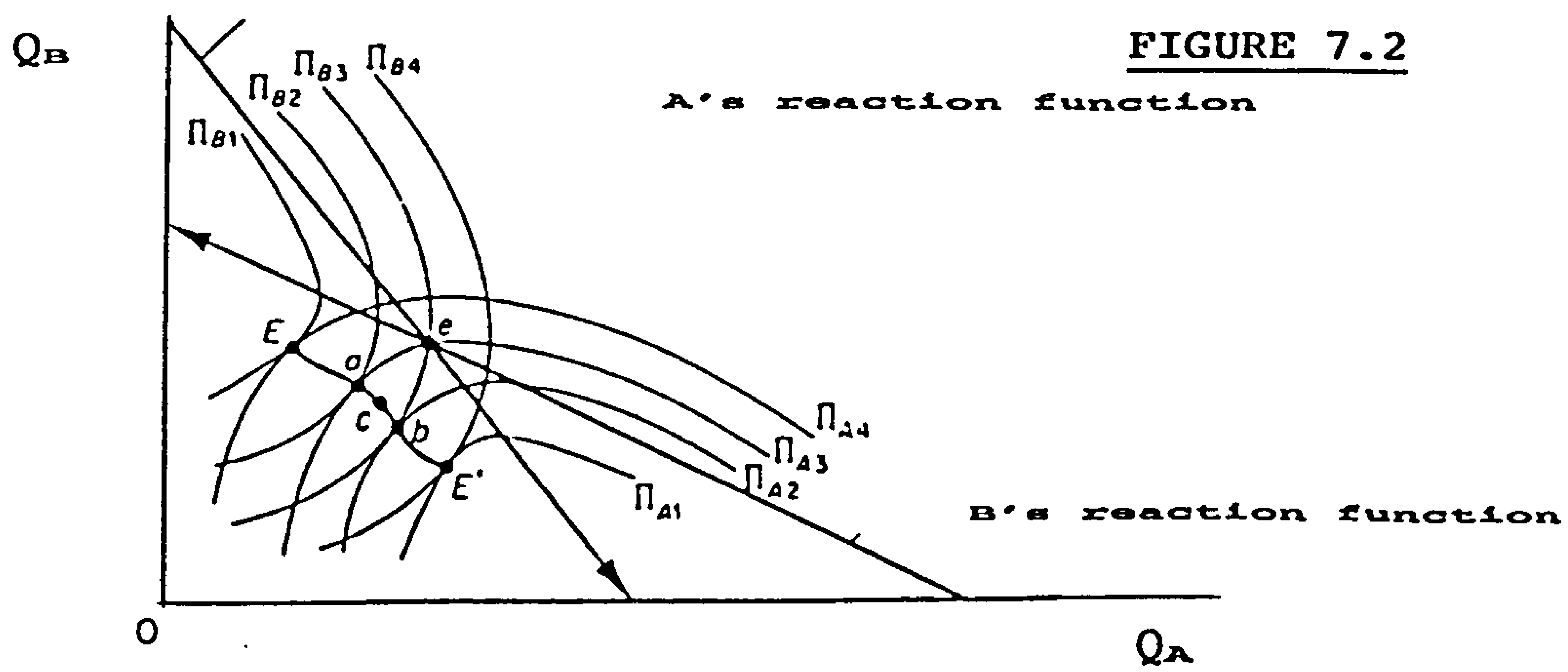
FIGURE 7.1



A's reaction function is traced out by the highest point on its isoprofit curves ($I_{a1}, I_{a2}...$). An isoprofit curve for firm A is the locus of points defined by different levels of output of A and rival B which yield to A the same level of profit. Thus each reaction function shows the profit maximising level of output for the firm given the choice of output of its competitor. Cournot's equilibrium is determined by the intersection of the two reaction curves. To see this, suppose A decides to produce quantity A_1. Firm B will react by producing B_1, given the Cournot assumption that firm A will keep its quantity fixed at A_1. However, A reacts by producing a higher quantity A_2 on the assumption B will stay at level B_1. Now firm B reacts by reducing its quantity to B_2. This adjustment will continue until point E is reached.

Note, however, that while at E each firm is maximising its own profits, industry profits (joint profits) are not maximised. In fact both firms could achieve higher profits if they ceased to act independently (see later models of collusive behaviour). This can be seen from a curve similar to Edgeworth's contract curve which traces out points of tangency of the two firms isoprofit curves.

FIGURE 7.2

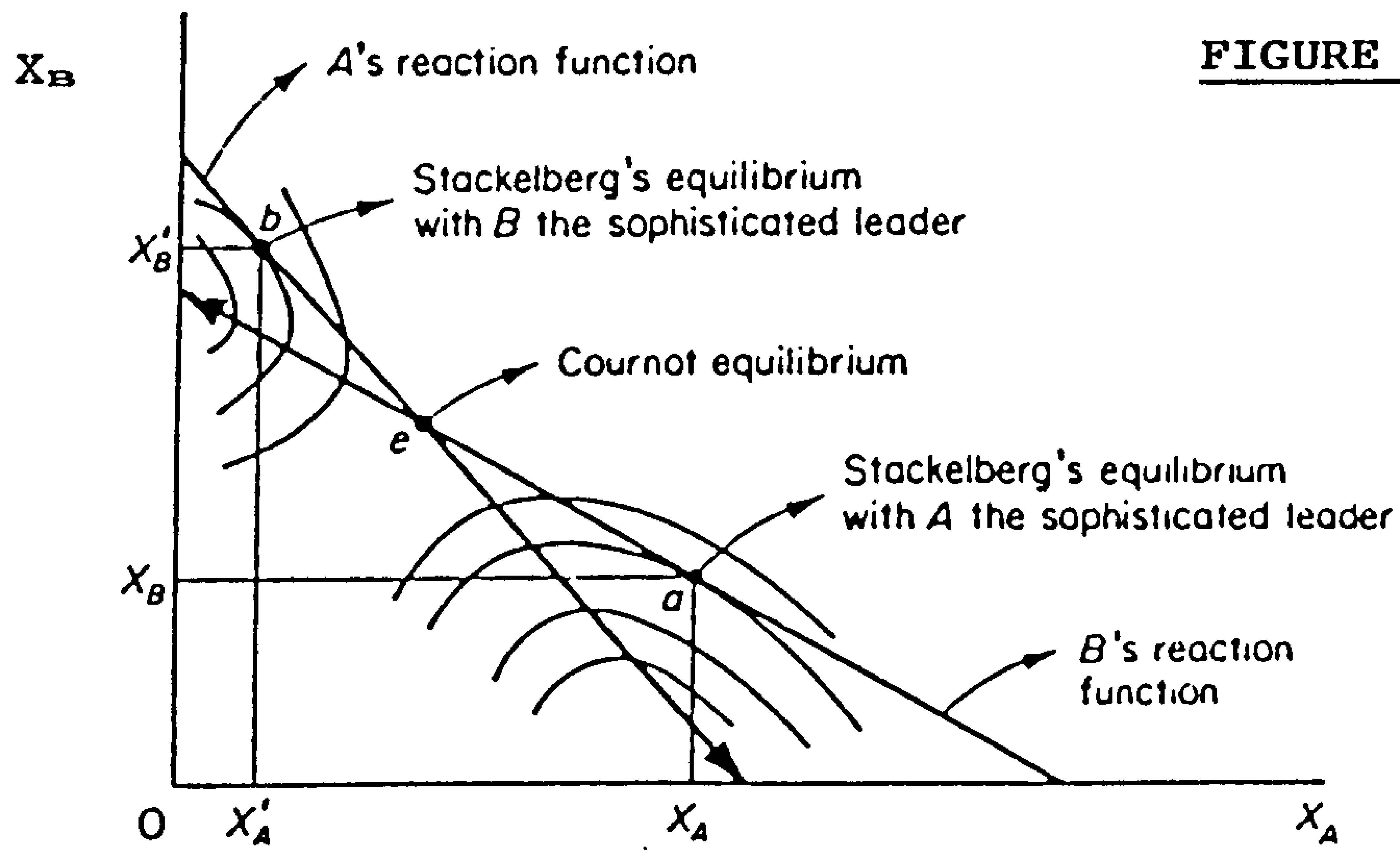


EE' is the Edgeworth's contact curve

Points on the contract curve a-b are optimal in that they imply higher profits for either one or both firms, that is, higher industry profits. The reason the suboptimal point E is chosen is that the Cournot pattern of behaviour implies that firms do not learn from past experience: neither firm realises that the other firm behaves on the same assumption.

In the Stackelberg model it is assumed that one duopolist is sufficiently sophisticated to recognise that his competitor acts on the Cournot assumption. This allows the sophisticated duopolist to determine the reaction curve of his rival and incorporate it in his profit maximising decision. The Stackelberg conduct assumption yields different solutions depending on which firm acts as leader.

FIGURE 7.3



If A is the sophisticated oligopolist, then he will choose to produce at point "a" which is the maximum profit he can achieve given B's reaction curve: profits are greater, the closer the isoprofit curve to the firms' respective axes.

This is where one of A's isoprofit curves is just tangent to B's reaction function. Conversely, if B is the sophisticated oligopolist, equilibrium will be achieved at point b which represents the highest level of profit B can achieve given A's reaction function. Note that in the Stackelberg model the sophisticated player is better-off, and the naive player worse-off, compared with the Cournot equilibrium. If, however, both firms are sophisticated the market situation becomes unstable: the result will either be a price war, until one of the firms surrenders and agrees to act as follower; or collusion with both firms abandoning their naive reaction curves yielding higher profits.

One type of collusive behaviour would be to form a cartel aimed at maximising joint profits. The firms appoint a central agency, to which they delegate the authority to decide not only the total quantity and the price at which to sell, but also the allocation of production among the members of the cartel and the distribution of the profits.

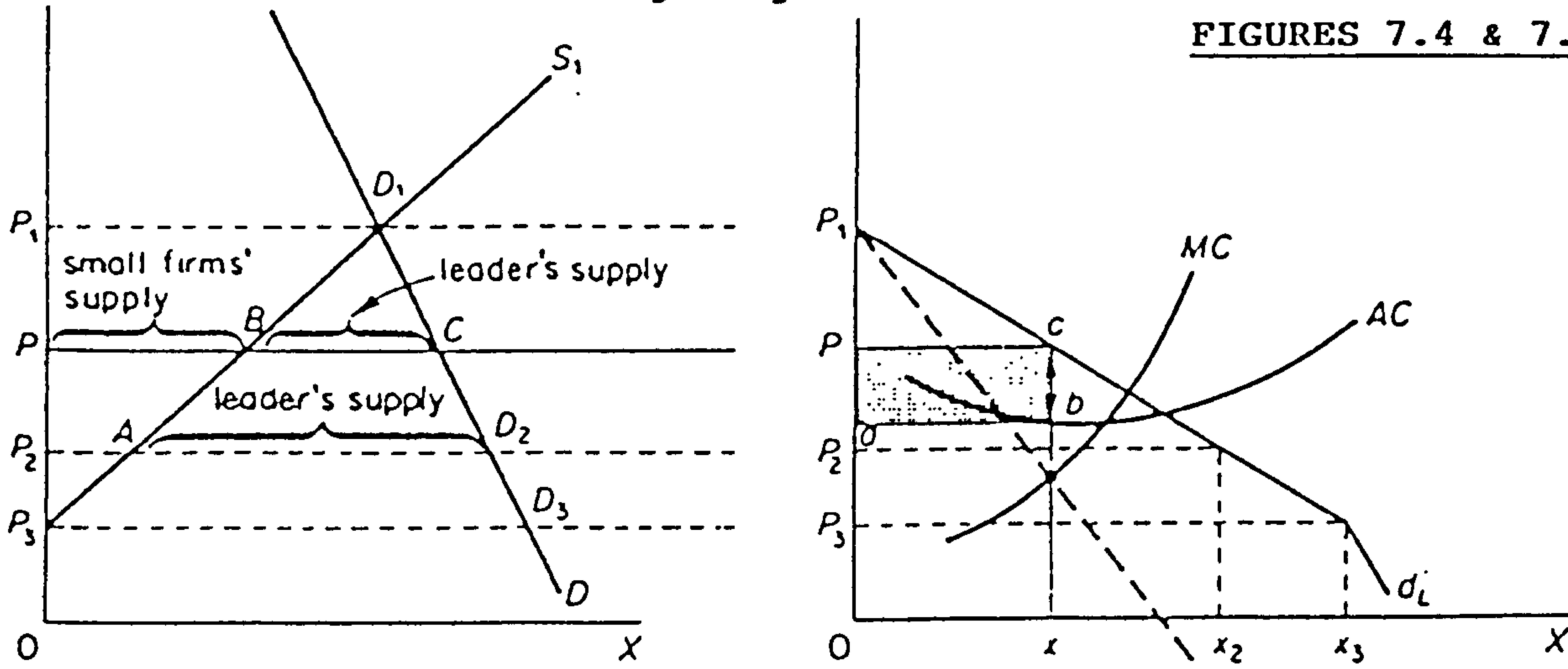
In practice a more common form of collusion is one in which firms agree to share the market, because it gives them more freedom in determining the style of their output, selling activities and other decisions. There are two basic methods of sharing the market : non-price competition and quotas. In non-price competition, firms agree on a common price at which each of them can sell the quantity demanded. The price is set by bargaining, with the more cost-competitive firms pressing for lower prices. The second method of sharing the market is to agree on quotas, that is the amount each member may sell at an agreed price. If all firms had the same cost structures, equilibrium would be achieved with the market being shared equally among member firms. Since this is rarely the case quota-shares are determined by bargaining. The final quota of each firm will depend on the level of its costs as well as on its bargaining skills.

Cartels are, however, inherently unstable, because of the uncertainty surrounding the behaviour of new entrants. A new firm may enter the market. Indeed, if the profits of the cartel members are lucrative and attract new firms, the newcomer has a strong incentive not to join the cartel, because by charging a slightly lower price he can secure a considerable share of the market. Of course, the cartel can either set a price so as to make entry unattractive, or threaten a price war if the newcomer undercuts them. Nevertheless, the entrant may still survive depending on his cost advantage and financial strength.

Another form of collusion is price leadership. One firm sets the price and the others follow, either because it is advantageous for them to do so, or because this reduces uncertainty about their competitors' reactions, even if it means diverging from profit maximisation. In most cases such behaviour is tacit because it is illegal in most countries.

Price leadership is more common than cartels, because it allows complete freedom regarding production and selling activities. It tends to take one of three forms : the leader can be the firm with the lowest costs, the largest (dominant) firm in the industry, or the firm which has the best knowledge of prevailing conditions in the market and is most able to forecast future developments (the barometric firm). The case of the dominant - firm price leader can be examined in the following diagram.

FIGURES 7.4 & 7.5



It is assumed that the dominant firm knows the market demand schedule DD and also the MC curves of the smaller firms which it can add horizontally to find the total supply by the small firms at each price. From this the dominant firm can work out its own demand schedule which will be that part of total demand not supplied by the small firms. For example, at price P, demand for the leader's product will be zero, because the total quantity demanded D_1 is supplied by the smaller firms. As the price falls below P, the demand for the leader's product increases. Given this demand curve and his MC curve the dominant firm will set the price at which MR=MC and his output is OX, that is price P and he will supply BC=OX and the smaller firms will supply PB.

Of course, there are many more conduct assumptions which may be examined. Above we have outlined but a few. Nevertheless, despite Cowling's (1976) extension to take explicit account of conduct, the SCP framework has come under criticism on several accounts.

7.5 CRITICISMS OF THE TRADITIONAL SCP PARADIGM

Two of the more popular criticisms of the SCP approach concern the limited number of variables considered, the restrictive nature of the conduct assumptions, and the issue of causality.

In its traditional form the SCP approach assumes that basic exogenous conditions determine the degree of concentration in an industry: given a particular choice of strategy, the higher the level of concentration, the more profitable the business. Concentration, however, is not the only element of structure.

STRUCTURE

The effects of concentration of sellers, and collusion between oligopolists, depends upon existence of barriers to entry. Bain (1956) suggests that the relevant ease with which a potential entrant can enter a given industry will affect the rate of profit within that industry. The height of the entry barrier determines the magnitude of profits. The higher the barrier to entry, the higher the "price - cost" margin, which is defined by Bain as : "the extent to which, in the long run, established firms can elevate their selling price above the minimal average costs of production and distribution without inducing potential entrants to enter [an] industry" (1968, p.252). Bain (1956) identifies three sources of barriers to entry. First, the dominant firm's unit costs may be lower because of scale economies in production, purchasing, capital raising, physical distribution, or advertising not attainable by smaller rivals. Therefore, the proportion of output of the industry which a potential entrant must supply in order to be reasonably efficient may constitute a barrier. Second, product differentiation barriers may exist because of long-established preferences of buyers for existing products - consumer loyalty : the problem is one of enticing away customers who are to some extent loyal to incumbent firms. Third, incumbent firms might have an absolute cost advantage over potential entrants in terms of lower input prices, operating at points on technology learning curves, and so on. In the absence of high entry barriers, the prices which can be charged by oligopolists will be limited by the likelihood that beyond a certain point new entrants will be attracted by excessive profits. By their very nature, the impact of barriers to entry on profitability may be expected to be non-linear. When entry barriers are not so high as to seriously deter entry, no effect may be expected, but when they are sufficiently high, seller concentration becomes an important factor (see Bain, 1951). (A fuller discussion of barriers to entry, and of how the threat of hit and run entry can influence a company's monopolistic power, is provided in the later chapter on contestable markets).

Other structural characteristics, as suggested earlier, would include the extent of vertical integration. It would be assumed that the degree to which a firm can control the source of its inputs and the destination of its outputs would influence profitability. Similarly, profitability would be affected by whether a firm produces homogeneous or differentiated products.

Omission of these characteristics can lead to mistaken conclusions, for, as Caves and Porter (1978) have argued, oligopolistic collusion may break down because exogenous variables change the demand or cost conditions. They suggest, for instance, that secular growth in industry demand, seasonal or cyclical variations in such demand, and innovations in products or technology emanating from high R&D expenditure can together break collusion, leading to price, quality, or promotional competition and instability in market share.

7.6 LIMITATIONS OF THE CONDUCT ASSUMPTION

As far as conduct is concerned, two aspects need to be discussed. First, even if we assume the firm's aim is to maximise profits, the level of output is not the only choice variable. For example, the firm must also determine the level of advertising and research and development expenditure required to achieve this aim. This said, however, it is a relatively simple step to give a much more general treatment of the profit maximisation problem with respect to a whole set of action variables (see Varian, 1984).

Nevertheless, this extended version of the neoclassical framework still falls far short of generating a full repertoire of possible conducts, mainly because it is so unconvincing in a behavioural sense. The assumption that economic agents possess perfect knowledge of all aspects relevant to their decisions has long been rejected by the Austrian and other schools of thought. They prefer to assume that knowledge is incomplete. For instance, consumers can be aware of their own tastes but may be unaware of all the consumption possibilities available. Producers may know the costs associated with current processes but may be unaware of the costs of alternative production techniques.

Likewise, they could well have a hazy notion of the true nature of demand for their product. The critics would argue that satisficing and bounded rationality are more appropriate assumptions to describe behaviour.

7.7 PROBLEM OF CAUSALITY

A third criticism of the SCP paradigm has been that it assumes a unidirectional flow of causality from structure through conduct to performance. Clearly, reverse causality is also possible in many of the relationships. For example, an oligopolist might direct his conduct at attempting to achieve greater market share, ie. a change in structure. This could be achieved by aggressive advertising, harassment in courts, or other steps to force rivals out of the market and thus promote an increase in concentration. Alternatively, research and development outlay can be used to change the structure of technology in an industry, and hence cost conditions and or the degree of product differentiation.

In defense of the SCP approach, however, few exponents of the paradigm claim that the causality is strictly one way. The aim is simply to establish the main thrust of causation. It is facile to argue that everything determines everything else. The objective of model building is to identify major causal connections. Nevertheless, with the advance of econometric techniques, it would be more convincing if studies were to test explicitly for causality. The problem is essentially one of simultaneity. Because each relationship is part of a much larger system, estimating one relationship (eg. the concentration / profit relationship) in isolation produces biased results. This is the well known problem of simultaneous equation bias.

7.8 APPRAISAL

This chapter has outlined one of the most influential approaches to examining the way in which external conditions can affect the performance of a business. In its primitive form the analysis is a rigid and implausible exposition of the factors which affect corporate performance. Proponents of the approach have attempted to deflect such criticism by amending the component parts of the paradigm in a piecemeal manner, but have not succeeded in dispelling doubt about the usefulness of the framework as a whole.

7.9 THE EMPIRICAL LITERATURE

The task of converting the theoretical concepts of the SCP paradigm into empirically testable hypotheses presents major difficulties. It is perhaps not surprising that the large number of empirical studies of the relationship between market structure and profitability to emerge since

Bain's seminal work have triggered a certain amount of disputation. In what follows a brief review of the literature is provided, though the account is inevitably more one of the problems and limitations of the studies in question. Nevertheless, the "conventional wisdom" gained from the empirical work still seems to suggest that a positive relationship between industrial concentration and profitability does exist, particularly when concentration exceeds some critical limit and when there are substantial barriers to entry.

7.10 A GENERAL MODEL

The most general formulation, more or less common to all studies of the SCP paradigm holds that:

$$\pi = f(C,B,OS,D)$$

profit is some function of market concentration, C, a set of entry barriers, B, a set of other structure variables, OS, and D denotes the level (or rate of change) in market demand.

A wide set of possibilities, however, arise from this framework. As Scherer (1980) points out, "market structure, as characterized by the concentration ratio may not be a true independent variable. It may itself be influenced by the pricing polices sellers choose, taking into account entry barriers" (p.268). Not only may profit be a function of concentration, but conversely concentration may itself be a function of profit. This leads Scherer to conclude that "some means of capturing the simultaneous working of [the] relationships .... must be found, especially when π variable is defined, as it was in Bain's original study, over a time interval sufficient for appreciable structural changes to occur" (p.268). There are several further problems in finding an appropriate statistical representation for the paradigm. We consider first the more basic problems of choosing appropriate measures for the variables employed in the approach.

7.11 MEASURING PROFIT

The π variable is typically measured by either the price-cost margin (Lerner Index) method, or by the rate of return method. Theory suggests that firms with greater market share are likely to be able to hold prices above the levels that would prevail under competition, that is, charge a price greater than marginal cost. The Lerner Index (1934) is defined as follows:

Lerner Index = (Price - Marginal Cost) / Price

A Lerner Index of zero would be recorded by a perfectly competitive firm; the closer the index is to one, the greater the market power. Apart from this being more a measure of potential rather than actual profit opportunities, a major problem arises in that it is difficult to obtain systematic data on business firms' marginal costs or the ratio of marginal costs to prices. As a surrogate measure, Scherer (1980) suggests the use of the ratio of price less average production cost per unit to price, but of course, this falls far short of the economic concept of the markup of price over marginal cost, that is, of a measure of monopoly power.

The data required to measure π as a rate of return on capital are easier to gather. Some studies look at the return on stockholders' equity, defined as:

$$\pi = (\text{Accounting Profit Attributable to Stockholders}) \;/\; (\text{Accounting Book Value of Stockholders' Equity})$$

Others look at the rate of return on capital:

$$\pi = (\text{Accounting Profit} + \text{Interest Payments}) \;/\; \text{Total Assets}$$

Serious questions have to be asked, however, about the consistency of the data used in the numerator and denominator in both measures. Difficulties arise because of diverse accounting policies across companies. For instance, the way in which companies value their assets is likely to pose a number of potential problems. Suppose the acquisition of one firm by another enhances the acquiring firm's monopoly power. It is then likely to pay a higher price for the acquisition than if no such monopoly potential were present. After the merger, the value of assets may be written up so much that profit returns appear only "normal". This is more likely if the acquiring firm uses purchase accounting methods, bringing the firm's assets onto its books at market value, than if it uses pooling of interest accounting, incorporating the acquired firm's assets at their book value. Other problems include the fact that assets may have been revalued more recently in some companies than others. Diverse depreciation methods across companies may make the comparison between profit rates after depreciation precarious. Research and development expenditure and brand names may be capitalised in some companies but not others. "Window dressing" may lead to the transfer of sales and profits between consecutive years. Profit measures can also reflect major differences that are due entirely to different levels of gearing. Finally, where profit is measured post-tax, vagaries of the tax system may further complicate comparisons. These problems have been explored by Singh and Whittington (1968), Whittington (1971), Meek (1977), and Foster (1978) among others.

Of course the problems are not entirely insurmountable. On the other hand they do suggest the need for a very careful scrutiny of the financial reports of companies before encoding data. Furthermore, there are both a priori and empirical grounds for expecting many differences in accounting practice to be industry-specific (see Lev (1969), Taffler (1976), Foster (1978)): thus use of more homogeneous sets of data should reduce distortions. At the very least the above arguments do suggest that the person analysing structure - performance relationships must be sensitive to the possible intrusion of biases so that their direction and probable magnitude can be acknowledged.

7.12 RECONCILING INDUSTRY AND FIRM DATA

When studying organisational behaviour the most natural context of analysis is the industry. However, raw performance data are almost always only available at the firm level. The problem is to reconcile firms' profit data with industry structure variables.

One solution to the problem is to identify the firm's primary industry, the industry in which it has the largest single share of its sales or assets, and add all relevant accounting variables to that industry's total. Besides the fact that data is often not available for all firms in an industry a more serious difficulty arises. For diversified companies, a large amount of irrelevant activity will be included in its primary industry. Since companies have become increasingly diversified, the contamination problem is likely to have grown more complex.

An alternative approach is not to aggregate firms into industries, but to focus instead on individual firms and compute weighted market structure indices for each firms particular situation. Scherer (1980, p.270) gives the example of a firm's with half its sales in an industry whose concentration ratio is 63, thirty percent of its sales in an industry, whose concentration ratio is 17 and the remainder in an industry whose concentration ratio is 96. The weighted average concentration ratio would be:

$$[(63\text{x}0.5)+(17\text{x}0.3)+(96\text{x}0.2)]=55.8.$$

Dalton and Penn (1971) show that using this method reveals a statistically significant relationship between profits and concentration, which was insignificant when the primary industry method was used. The problem with the weighted average method, however, is that it compresses especially high and low structural index values towards the mean for all industries and this weakens the power of regression analysis to detect systematic structure - performance relationships. The ideal solution would be to obtain disaggregated data on profits of each firm in separate industries. Such data is available in some cases, for example the data from the Financial Accounting Standards Board in the United States. The problem with the data, however, is that companies have broad discretion to define the break-down by activity as they please, so that industry segments are not comparable from firm to firm.

7.13 MEASURING CONCENTRATION

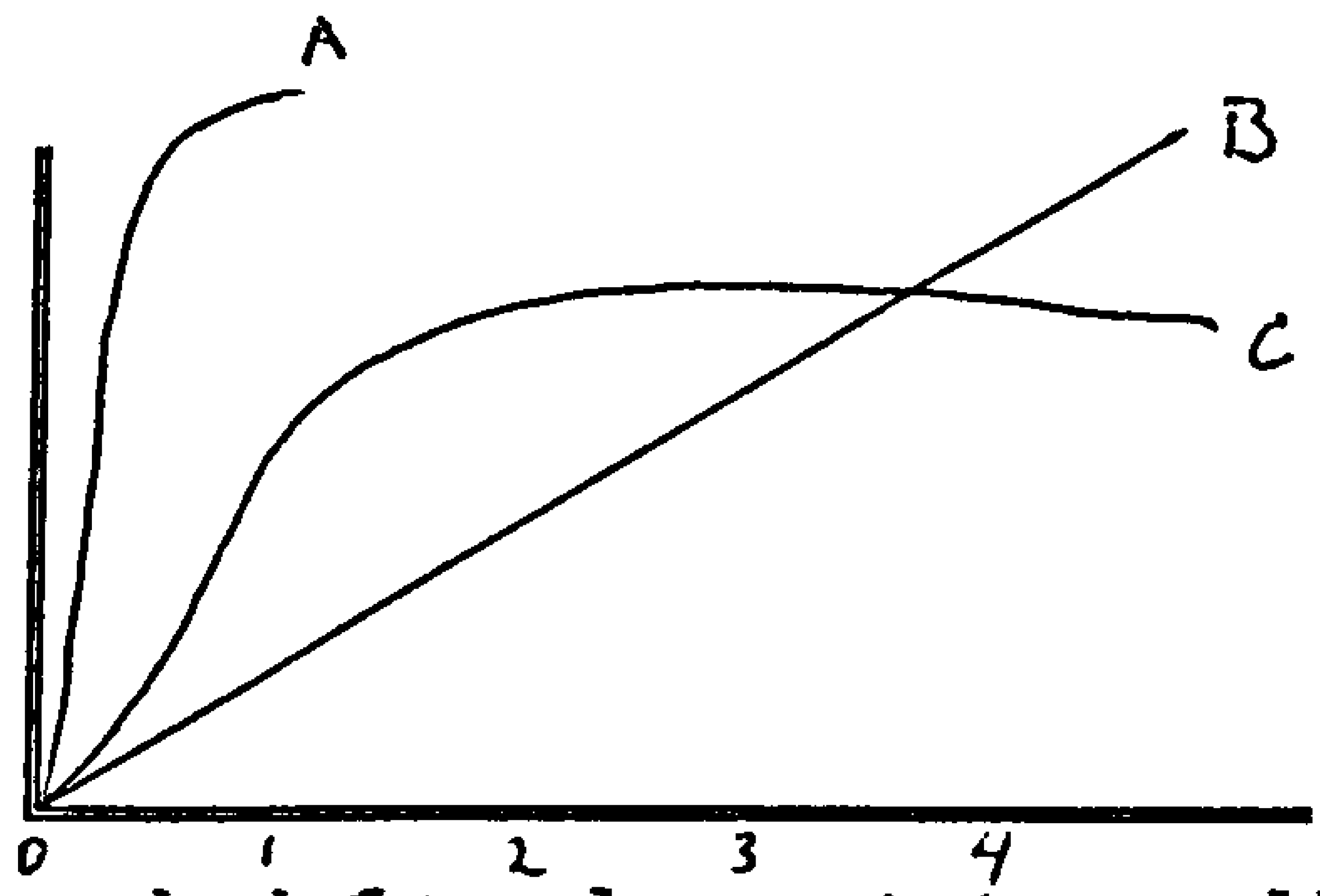
The attraction of concentration as a measure of market structure is easily understood, because differences in the number and size distribution of firms are key factors distinguishing the theoretical models of perfect competition, oligopoly and monopolistic competition. Furthermore, market concentration is easily estimated since data on the number and size distribution of firms are generally available, whereas for other structural variables, information is difficult to obtain. Ferguson (1988) has argued, however, that "at best, market concentration provides a limited guide to the structure of a market" (p.23). To understand his argument, it is necessary to consider more carefully the construction of these measures and their theoretical properties.

Measures of market concentration can be divided into two broad categories, absolute and relative measures.

ABSOLUTE MEASURES

(1). Simple concentration ratios are the most popular measures of concentration in empirical work and are derived directly from a concentration curve. This is formulated by ranking the top N firms within an industry in declining order of size (defined as the percentage of total industry sales, or capacity, or employment, or value added, or physical output) and then plotting their cumulative market share.

Figure 7.6



Number of firms ranked from largest to smallest

In general then,

$$CR_n = \Sigma S_i$$

where CR_n = the proportion of output attributable to the top N firms in the industry.

S_i = the percentage of market share of the ith firm.

In fact, by far the most frequently used measure is the four firm concentration ratio.

(2). The Hirschman - Herfindahl Index (HHI) (Hirschman 1964) is given by the formula:

$$HHI = \Sigma S_i^2$$

where S_i is the market share of the ith firm, measured as the output of the ith firm divided by the total output. When an industry is occupied by only one firm (a pure monopolist), the index attains its maximum value of one, and will be close to zero when there are a large number of equal sized firms. By squaring market share, the HHI index weights more heavily the values for large firms than for small. This index is often expressed as a "number equivalent" measure of concentration. For example, taking the reciprocal of HHI value of 0.2 would indicate that the market is comprised of five equal size firms.

(3). The Hannah and Kay (1977) index is similar to the HHI index except that market shares are raised to a power alpha, the choice of which is left to the investigator. Hannah and Kay suggest that an alpha in the range of 0.6-2.5 yields the most sensible results. The measure is calculated as:

$$HK_{(number\ equivalent)} = (\Sigma\ S_i^{\alpha}\ )^{1/(1-\alpha)}$$

Thus it can be seen that the Hirschman - Herfindahl index is a special case of the Hannah and Kay index, where S_i is the market share of the ith firm, and alpha is an elasticity parameter, the value of which determines the weight given to the large firms relative to small ones.

(4). The Entropy Index (Jacquemin and de Jong (1977), Marfels (1971), Horowitz (1971)) is defined as:

$$E = \Sigma S_i \log(1/S_i)$$

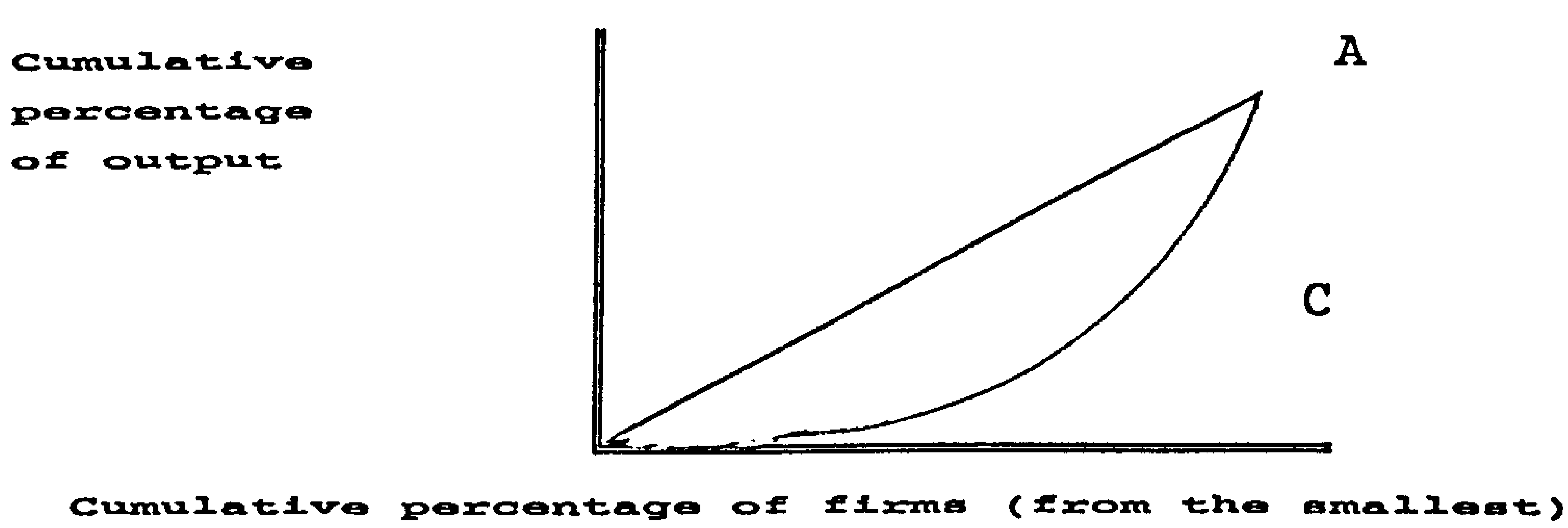
This index weights market share by the logarithm of market share. When market shares are equal, its value reduces to log N, being zero under pure monopoly and rising non-linearly as the number of firms increases.

The advantage of this measure is that it can be decomposed to show how different sub-groups contribute to the overall level of concentration.

RELATIVE MEASURES

Relative measures of concentration, on the other hand, focus on the difference in firm size, and effectively ignore the number of firms competing within an industry. The more unequal the size distribution of firms, the more concentrated and less competitive the market.

Figure 7.7



(1). Gini Coefficients are derived from the Lorenz curve, a graphic technique which ranks firms by size and is cumulated from smallest to largest as a percentage of the number of firms in the market. This is plotted against the cumulative percentage of market output. The Gini measure summarises how far an observed Lorenz curve actually observed is located from a curve that would appear if all firms had equal market share or sales (line of absolute equality); the greater the deviation, the greater the inequality in firm size.

(2). Variance of the Logarithms of Firm Size, (Hart and Prais (1956), Utton (1971)):

$$V = 1/n\ \Sigma(\log S_i)^2 - 1/n^2\ (\ \Sigma \log S_i)^2$$

measures the frequency distribution of a stochastic process over time. As with the entropy index, this can be decomposed, and its value tends to zero if all firms are identical in size.

"Many industrial economists believe that, despite being a little crude and frequently somewhat ad hoc, concentration indices can be useful in assessing the state of competitiveness in markets" (Doivsimoni et al 1984, p.419). To assess this claim, we must consider more carefully some of the assumptions and limitations of the concentration index approach.

According to Neoclassical theory, competitiveness is a function of the number and size distribution of firms within a market. Any measure of concentration, therefore, should seek to capture these two elements. The relative concentration measures do not take account of the number of firms. For example, the variance of logarithms measure converges on zero when the firms are the same size. We would obviously expect economic performance to differ if there were two, as opposed to two hundred, equal-sized firms within a market. This problem is overcome using the entropy measure, where the maximum value is dependent upon the number of firms competing.

Concentration ratios are also flawed because they consider only partially these two elements. They neglect all except the top N firms. For example, two industries could both have a five firm ratio of say, 60%, but one industry comprising 10 small firms and the other, 100 small firms. As a result, the same concentration ratio would describe a competitive market where there are N similar-sized firms or a situation close to monopoly where one firm dominates. A further criticism is that concentration ratios are arbitrarily chosen from a concentration curve, so the ranking of an industry depends critically on the point chosen. In Figure 7.1, on the basis of a four firm concentration ratio, industries B and C are identical. For measures of more than four firms, B is more concentrated than C. Furthermore there is no theoretical underpinning for preferring a four firm ratio to a higher or lower ratio.

The Hirschman - Herfindahl index is theoretically elegant. It includes all firms, and squares their respective market shares giving greater weight to larger firms. However problems arise with interpreting the reciprocal of the index, the number equivalent value. This measure does not correspond to a unique size distribution of firms within the industry. Rather it indicates a value that would be obtained if the market were comprised of that number of equal-sized firms. This defect also mars the Hannah and Kay measure. Both measures are faced with the lack of theoretical guidance when choosing the size of alpha.

Hannah and Kay (1977) have suggested a number of other desirable attributes that a concentration measure should have. First is the concentration curve ranking criterion. Referring to figure 7.1, concentration measures which are situated above another should rank their respective markets as more concentrated, i.e. market A is more concentrated than market B. The variance of logarithms measure does not adhere to this criterion.

Second, the sales transfer principle stipulates that if customers switch from smaller to larger firms then the concentration ratio should increase, and vice-versa. The concentration ratio will meet this criterion only if the transfer is between the N largest firms and those outside the largest N firms. If the transfer is between the N largest firms the index will not change.

Third, if the new firms enter, gaining market share below the average firm, the measure of concentration should fall. Gini and variance of logarithms measures do not satisfy this axiom. In the case of the concentration ratio, the problem is that entry of new firms outside the N largest firms is unlikely to alter the market share of these firms.

Fourth, Hannah and Kay suggest that mergers should lead to an increase in the measure of concentration. Again the concentration ratio, Gini, and variance of logarithms measures do not always satisfy this axiom. If the merged firms are within the largest N firms, or the merger is between a firm in the largest N and one outside the group, the ensuing result will be a higher concentration ratio. However if the merger is between two or more firms outside the N largest firms, the concentration ratio will be unchanged.

The analysis so far has outlined the different ways in which studies of the concentration - performance relationship have attempted to measure concentration and the shortcomings of the various measures. Some have argued, however, that concentration is not the best indicator of market power. A major deficiency is that market concentration fails to recognise linkages between firms. Profitability could differ from concentration predictions if firms share the same distribution channels, or if they engage in joint market and production agreements, and so on. The existence of collusive behaviour would distort the concentration-performance relationship, leaving concentration measures as misleading guides to the kaleidoscope of market structure.

A further major problem is that measures of market concentration fail to identify companies within industries. Empirical studies may suggest that in 1985 the four-firm concentration ratio, say, is 70% for industry X and remains unchanged three years later. Interpreting these results would imply that competition remained unchanged and that competitive forces are weak. However this may not be the case; rather the four largest firms may have been replaced by four new firms by 1988, and may be completely different animals.

7.14 MEASURING BARRIERS TO ENTRY

Bain (1956) was initially responsible for the inclusion of barriers to entry as a variable in the concentration-profit relationship. Concentration may be conducive to tacit or explicit collusion, high prices, and high profits, but unless there are appreciable barriers to entry, high profits will tend to attract new entrants. However, there are still problems in that barriers to entry alone are not sufficient to ensure the existence of long run profits. If the number of firms in an industry reaches some appreciable number, rivalry among incumbent firms could overshadow the threat of potential entry. This suggests that the barriers to entry variable will be significant only for industries with a few firms. This problem is rarely taken into consideration in the empirical studies.

Barriers to entry have been included in studies of concentration-profit relationships in three forms.

Advertising-sales ratios (A/S) are commonly employed as explanatory variables when problems with data collection can be overcome: the basic difficulty is the absence of comprehensive, consistent, industry-by-industry information on full promotional, as opposed to selective media expenditures. There is also a conceptual problem in that the advertising variable on its own may be a better predictor of monopolistic power (Kelly and Cowling, 1973).

The second measure used to describe barriers to entry, and one that is frequently used in conjunction with the A/S ratio, is the capital-output ratio (C/O) for the industry. A major difficulty here is that the capital requirements for entry into an industry operating efficiently may be low: the C/O ratio however, may be high, and vice versa.

A third measure is one of the minimum efficienct scale of plant (MES), expressed in terms of investment or employment requirements. This measure is easier to identify within the paradigm, but is unfortunately rarely available. As proxies for MES, average capital or employment per establishment in an industry are sometimes used.

7.15 THE EMPIRICAL FINDINGS

Having reviewed the measurement problems which arise in studies of the structure-performance relationship, we turn now to outline the main results to emerge from these studies. The objective is to reveal the main conclusions to emerge rather than attempt a comprehensive review of the literature.

A most influential study was the 1951 article by Bain, "Relation of Profit Rates to Industrial Concentration". He found that in industries with eight-firm sales concentration ratios of 70% or higher, the average after-tax return on shareholder equity was 12.1%, compared to 6.9% for industries with concentration ratios below 70%. Furthermore, this difference was highly significant. In a later book Bain (1956) attempted to take into account the effects of entry barriers as well as concentration on firm performance. His results, along with those of Mann (1966), found that, as hypothesised, highly concentrated industries with very high entry barriers had higher rates of return than other highly concentrated industries with lower entry barriers.

These results have been criticised on a number of grounds. Some have criticised the subjective nature of the way in which Bain classified entry barriers: he defined very high entry barriers in terms of the ability to hold prices 10% or more above minimum unit costs without inducing significant new entry, and substantial barriers as the ability to hold prices 5 to 9 percent above costs.

A second criticism concerns the way industries are classified as having a high, medium or low degree of concentration : Singer (1970), taking a peculiarly broad definition of the car industry, was able to reclassify it as of a medium degree of concentration, and found that this was sufficient to eliminate the profitability differences between industries of high and moderate concentration. A third problem with the Bain and Mann studies was the small size of the samples analysed: this relates to the problem mentioned earlier of defining an industry. Bain and Mann attempted to limit their attention to well-defined industries for which adequate profitability data could be obtained when companies were assigned to industries according to the primary industry criterion. Brozen (1971) showed that when larger and less discriminating industrial samples are used, the positive association between profitability and concentration deteriorates. This is hardly surprising, since it is much more difficult to detect systematic relationships when the independent variables are badly measured. Collins and Peston (1969) have shown that the problem of obtaining large enough samples, in which performance data are correctly matched to structural data, can be overcome if other limitations are accepted. Using price-cost margin statistics, and correcting for poorly defined markets by including a geographic dispersion index, they find a modest but significant relationship between price-cost margins and four-firm concentration ratios.

One could discuss at length the results of these and many other studies relating some kind of index of profitability to concentration, entry barriers and other variables, but as Scherer points out, "despite sometimes formidable mismeasurement, there is a rather robust tendency for a positive association to emerge between seller concentration and profitability" (1980, p.278).

There has been less success, however, in determining the exact nature of the relationship. To determine whether the relationship is linear or not, studies have attempted to test whether the Hirschman-Herfindahl Index or the simple concentration ratio is the more appropriate. The results, however, are ambiguous: in some cases the HHI index exhibited greater explanatory power. In others the four-firm concentration ratio did better (see Stigler (1964), Weiss (1971), Jones, Laudadio and Percy (1973), McFetridge (1973), Kwoka (1979)).

On the issue of continuity, that is, whether profit rates increase steadily as concentration increases, more extensive research has been undertaken (see Kilpatrick (1971), Rhoades (1973), Rhoades and Cleaver (1973), Meeham and Duchesnean (1973), Datton and Penn (1976) , and White (1976) among others). The conclusion is almost unanimous. Virtually all studies show a significant increase in profit rates as the four-firm concentration ratio passes through a range between 45 and 59%.

However, once some sort of consensus appeared to have been reached concerning the relationship between market concentration and profitability, the debate moved on to a fundamental problem neglected earlier. It was long assumed that the degree of concentration affected firm performance because of the power it gave firms to raise prices. Demsetz (1973), however, pointed to a completely different interpretation. He suggested that industries become concentrated because one or more firms have a strong efficiency advantage over their competitors. It is this greater efficiency which leads to industry concentration and thus greater profitability. If the efficiency explanation is right, a positive relationship between profitability and market share of firms would be expected, because as Demsetz argues, "if efficiency is associated with concentration, there should be a positive association between concentration and the difference between the rate of return earned by large firms and that earned by small firms" (1973, p.5). On the other hand, if the monopoly power hypothesis is correct, higher prices should benefit all firms equally and so there should be little or no differences in the profitability of firms of different size within an industry. Empirical work by Demsetz and also by Carter (1978) has tended to support this hypothesis.

Scherer (1980), however, has suggested that the matter is not easily resolved. He argues that if firms in an industry operate according to a production function exhibiting economies of scale, there would be a natural tendency over time for the larger firms to be more successful and for the industry to become more concentrated. Higher industry profitability could arise solely from the larger firms operating at lower points on long run cost functions. The problem then is one of distinguishing the effects of scale economies from the entry barriers and / or concentration effects. In both cases industry profitability is higher in concentrated industries and, within these, higher among large firms. Furthermore, Bond and Greenburg (1976) show another possibility which would fit these observations. They suggest that product differentiation advantages would allow firms to charge higher prices, without necessarily having a cost advantage. Scherer (1980) also suggested that the recent increases in concentration in the U.S. had come about through successful advertising campaigns in conjunction with scale economies. This relationship, he argues, following Comanor and Wilson (1967), reflects the ability of sellers to hold prices of strongly differentiated products above costs, and has led many to include an advertising sales ratio as an explanatory variable.

The essential point of the above discussion is that the profit differences associated with market share are significantly more complex than first envisaged by Demsetz, embodying a complex mixture of scale economies, cost, price and production differentiation advantages. Both Clarke, Davies and Waterson (1984) and more recently Harris (1988) attempt to take account of all these factors. The results of Clarke et al. suggest that "both efficiency and market power effects are at work" (1984, p.448), whereas the work of Harris lends more support to the innovative leading firm alternative suggested by Demsetz. Neither study, however, is able to reject the product differentiation hypothesis in favour of that of leading firm efficiency. That is, there is no certainty that larger firms will achieve higher profit rates in industries without collusion, as suggested by Demsetz.

Some of the other results to have emerged from the many statistical studies of structure-profitability relationships are worth mentioning. Financial theory suggests that the degree of profit risk perceived by investors will influence a firm's equilibrium profit rate. Higher risk raises the required rate of return on equity, thereby raising the critical rate for firms' investment projects. Thus one would expect profits to be higher in industries that involve, in some sense more risky activities. A study by Harris (1986) which incorporates risk in the form of the well known beta coefficient supports this hypothesis, but other evidence from Bothwell, Cooley and Hall (1984) finds no such relationship. Scherer (1980) has also attempted to discover whether concentration and risk could conceivably be related by way of a tendency for concentrated industries to oscillate between episodes of collusion and price warfare, again the evidence is ambiguous.

An issue addressed by some studies is the appropriate unit for analysis. We have already mentioned that the notion of the "industry" becomes problematic when firms are highly diversified or goods differentiated. Cubbin and Geroski (1987) have also demonstrated that considerable heterogeneities exist within industries: they argue that, because of this, analysis at the industry level is not only uninteresting but misleading.

7.16 CONCLUSION

The SCP paradigm continues to dominate the industrial economics literature. Even its most vehement proponents, however, would be hard put to claim that the paradigm provides a clear, unambiguous theoretical foundation for the study of firm-industry relationships. Some sort of positive association between concentration and barriers to entry and performance emerges from most of the empirical studies, but it is by no means clear that the relationship reflect the causal processes specified in the SCP paradigm. Further, the paradigm is ambivalent on the precise scope for firms gaining a competitive advantage over market rivals - in particular there is no clear analysis of the extent to which "barriers to entry" can be affected by dominant firms as opposed to being part of an inherent and immutable set of market conditions.

Baumol (1982) has added a new perspective to the relationship between structure, conduct and performance. His idea of contestable markets implies that a particular market structure does not necessarily translate into a particular type of performance. What is more, it is this analysis which in fact has subsequently helped to clarify the exact scope for strategic market moves by firms. It is to these issues that we now turn.

CHAPTER 8

CONTESTABLE MARKETS THEORY

8.1 INTRODUCTION

In the previous chapter we considered the structure-conduct-performance paradigm, in which the key to improved performance is taken to involve a change in market structure in the form of, for example, the erection of barriers to entry. This paradigm is ambivalent on whether the structural variables which affect performance are part of some "state of nature" over which firms have little or no control, or whether market structure is susceptible to manipulation by firms. In this chapter we consider the latter alternative, and examine the possible routes whereby a firm might gain competitive advantage by means of strategic market moves. In Section 8.2, we examine the nature of markets in which such moves are <u>not</u> possible. This may seem a strange way to advance the argument - but, as we shall see, an examination of the precise market conditions which make strategic interaction impossible (the so-called "contestable" market conditions) serves to clarify the market conditions necessary for the possibility of strategic moves by firms. With these conditions defined, we proceed to examine the scope of the contestable markets paradigm. The conclusion to emerge is that many markets are likely to be non-contestable and hence open to strategic manipulation.

8.2 CONTESTABLE MARKETS

It is clear that highly competitive markets leave little or no scope for strategic behaviour between firms. A perfectly competitive industry is one characterized by increasing marginal production costs, costless exit and entry, and undifferentiated products. These products are sold exclusively on the basis of market - determined prices. In such an industry, each firm produces at the point where price equals marginal cost. Any excess returns to capital available at this point quickly attract new entrants to the market, and the additional capacity quickly drives the market price down to a level where supernormal returns are completely eroded.

The theory of perfectly contestable markets is a generalization of this notion of a perfectly competitive market, and serves to clarify a general set of market conditions which leave no scope for strategic interaction between firms. The precise characterization of a perfectly contestable market necessitates the introduction of some terminology and definitions as follows.

Consider a vector of products $N = \{1,2,3....n\}$, which is a subset of all the goods in an economy. The prices of these products are represented by price vector p, and the prices of other goods are assumed to be exogenous and are suppressed from the notation. Q(p) is the vector valued market demand function for the products in N. For any output vector y, C(y) is the cost of producing y at exogenously fixed factor prices when production is efficient. The underlying technology summarized in this cost function is assumed to be freely available to all incumbent firms and to all potential entrants.

DEFINITION 1

A feasible industry configuration is composed of M firms producing output vectors $y_1....y_M$ at price p such that markets clear,

ie. $\Sigma y_i = Q(p)$

and that each firm at least breaks even,

ie. $p*y_i - c(y_i) \geq 0$.

In other words, " industry configuration" refers to the degree of concentration on the sellers' side of the market: with M=1, for example , the structure is monopolistic, while "feasibility" refers to the requirements that each firm involved chooses an output vector that permits its production costs to be covered at quoted market prices and that the sum of the outputs of the M firms satisfies market demand at those prices.

DEFINITION 2

A feasible industry configuration over M, with prices p and firms' outputs $y_1 \ldots y_M$ is sustainable if $p_a y_a \leq c(y_a)$ for all p_a and y_a such that $p_a \leq p$ and $y_a \leq Q(p_a)$.

The interpretation of this definition is that a sustainable configuration affords no profitable opportunities for entry by potential entrants who regard incumbents' prices as fixed. Here, a feasible marketing plan for a potential entrant is comprised of prices, p_a, that do not exceed the incumbents' quoted prices, p, and quantity vectors y_a, that do not exceed market demand at the entrants' prices, $Q(p_a)$. The configuration is sustainable if no such marketing plan for an entrant offers a positive profit flow.

With these two definitions, we may now proceed to define a perfectly contestable market as follows:

DEFINITION 3

A perfectly contestable market is one in which a necessary condition for an industry configuration to be in equilibrium is that it is sustainable.

A perfectly contestable market so defined may be interpreted, heuristically, as a market subject to potential entry by firms who have no disadvantage relative to incumbents, and who can assess the profitability of entry. Then, since one requirement of equilibrium is the absence of new entry, an equilibrium configuration in a perfectly contestable market must offer no inducement to entry, ie. it must be sustainable. Dixit (1982) has neatly summarized these requirements for a perfectly contestable market as follows:

[1]. all producers have access to the same technology;

[2]. this technology may exhibit non convexities, but costs must not be sunk (see below);

[3]. consumers respond instantly to price changes announced by firms;

[4]. firms do respond instantly to price changes announced by rivals.

To Dixit's definition, we should perhaps add:

[5]. there is perfect information available costlessly to all agents in the market.

Sunk costs play a key role here. A cost is sunk if there is a degree of irreversibility attached to it. This is most likely to be the case with certain capital expenditures where there is no active re-sale market, nor any possibility for the capital to be transferred from one production opportunity to others. Let us then focus attention on the five conditions above which define a perfectly contestable market. There would have been little point in developing the contestable market model but for the fact that there are striking implications for the behaviour of firms in such markets. A full catalogue of these implications can be found in Baumol (1982). For our purposes, let us focus on those implications which relate directly to the issue of strategic interaction between firms.

<u>PROPOSITION 1</u> - there is no scope for price competition in a perfectly contestable market.

Proof : To prove this proposition we need to be able to show that a firm will be unable to survive if it prices at less than marginal cost (this is the conventional definition of predatory pricing - see, for example Sharkey, 1985). If an incumbent firm sells q units of output at a price p that is less than marginal cost, and makes total profits π in the process, then it is possible for a rival firm to sell q-1 units of output which must yield profits of greater than π (since a marginally unprofitable unit of output has been removed from the production process). The rival firm can use this marginal increase in profits to undercut the incumbent firm which under assumptions (3) and (4) above will lead to the incumbent being eliminated from the market. Hence predatory pricing ($p \le MC$) is impossible in a contestable market.

<u>PROPOSITION 2</u> - there is no scope for non-price competition in a contestable market.

Proof : To prove this proposition we need to be able to show that any firm which attempts to produce with any sort of inefficiency (such as excess capital) will be eliminated from the market. The demonstration of this is quite straightforward. Any form of inefficiency, be it in allocation of inputs, or X inefficiency etc, constitutes an invitation to entry. By removing the inefficiency, the entrant can increase profits relative to those of the incumbent, permitting the entrant to lower prices which must eliminate the incumbent from the market.

Thus, as we have seen, a perfectly contestable market rules out the possibility of strategic interaction between firms. The theory of contestable markets outlined above initially seems to offer an exciting new approach to the analysis of oligopolistic markets and strategic advantage. The argument, in brief, is that competitive advantage is unsustainable in contestable markets, prices being quickly driven down to levels reflecting the marginal costs of production. There is no room for structure or conduct variables to create a competitive advantage in a contestable market. Further, the approach was motivated in good part by the belief that many markets are contestable, exhibiting such characteristics empirically.

It needs to be pointed out that only in the case of constant returns to scale perfect contestability implies that the equilibrium price is equal to both marginal and average cost. When we have the case of increasing returns to scale perfect contestability implies that the equilibrium price is equal to the average cost, the latter being above the marginal cost.

In what follows we will consider whether there is any evidence to support the contention that the threat of potential entry does in fact drive prices down closer to levels reflecting marginal costs, ie. competitive advantage is unsustainable in a contestable market; and whether the conditions for a market to be classified as contestable are met in reality.

8.3 IS COMPETITIVE ADVANTAGE UNSUSTAINABLE IN A CONTESTABLE MARKET?

The contestable markets literature provides a convincing theoretical argument for the proposition that the threat of potential entry should limit a firm's ability to exert monopolistic powers. The next question of importance, however, is whether this argument is important empirically.

A number of empirical studies have used experimental simulation of market behaviour as a means of investigating contestability issues. This work used human subjects, real money payoffs and experimental rules to restrict cost functions and other pertinent parameters. The object is to compare the solution predicted by theory with the actual behaviour of the experimental subject. One such study was undertaken by Coursey, Isaac and Smith (1984). Their aim was to determine whether complete freedom of entry and exit, ie.

zero sunk costs, in a market which could most cheaply be served by one firm, would yield prices close to the competitive level, the "weak" contestable markets hypothesis, or whether the prices would actually be equal to the competitive level, the "strong" contestable market hypothesis. The procedure was to provide two participants with a certain sum of money which they were required to spend in accordance with a strictly decreasing and known marginal cost function, their costs depending on how much they "produced". The consumer's demand function was also given but not known by the seller. Both sellers were required to reveal their price and quantity offers at the same time and the successful seller was the one who offered the lower price. The authors concluded that "the .... experiments strongly support the contestable markets hypothesis, namely, that to observe approximately competitive behaviour by a single producing firm with substantially decreasing costs, it is sufficient that (a) sunk costs are zero and (b) there are two contesting firms acting non-cooperatively in the sense that there is no explicit non-price communication between them that leads to excessive restriction of supply" (1984, p.69).

Harrison and McKee (1985), however, found that their results supported only the "weak" version of the contestable markets hypothesis. In numerous replications of the above experiment they found that while some of the simulation did yield the M=0 value expected of perfect contestability (where M is a index of monopoly effectiveness), this value occurred in only 29% of the simulations. Thus they concluded that "clearly, we can reject the strong form of the CMH (contestable markets hypothesis)" (1985, p.13).

In a further test, however, Harrison did find support for the strong version of the contestable markets hypothesis. He tests the effects of assuming that entrants take the incumbent's price to be given (the Bertrand-Nash assumption), a premise widely associated with contestability. This was achieved by letting all participants offer prices simultaneously in the first period. The next period's incumbent was determined as the one posting the lowest price, who was then obliged to announce a price before the others. The author concludes that ".... satisfaction of the Bertrand-Nash assumption is associated with a dramatic decline in (M) .... moreover, we find support .... for a strong form of the (contestable markets hypothesis) that claims that observed prices will converge to and attain competitive predictions" (1985, p.37).

It appears, therefore, that simulation evidence provides support for the contestable markets hypothesis. There are, however, major doubts as to whether behaviour in artificial experiments has any clear relationship to behaviour in actual markets. Given such doubts, it is necessary to assess the contestable markets theory in terms of whether the conditions for contestability hold empirically.

8.4 DO THE CONDITIONS FOR CONTESTABILITY HOLD?

As Baumol and Willig (1986) point out, "the real question .... is not whether competitive results will emerge under perfect contestable conditions but how often such conditions are likely to exist" (p.17). Studies in this area have usually found that markets which a priori might have been thought to be contestable, have not in fact met the rigorous criteria of contestability under close examination.

Let us take for example, the case of air-transport, to which the contestable markets paradigm was initially applied with much enthusiasm. A priori, it might have been thought that the air transport market was contestable - "capital", in the form of aeroplanes, is available to all potential carriers at the same cost, and furthermore investment in aeroplanes by airlines does not incur "sunk" costs, since the capital can literally be flown to other domestic or international markets, should exit from any particular market prove necessary. Furthermore, while consumers can respond almost immediately to price cuts, airlines are, at least over some period, committed to published prices and hence cannot respond instantly to price changes by market competitors. Thus on all counts, the airline market fulfils the conditions of contestability detailed in section 8.2 above, and it was these sorts of conditions which added considerable intellectual weight to the argument for deregulation of the airline industry in the U.S., since it was hoped that contestability would ensure marginal cost pricing as is required for "first-best" Pareto optimality.

In fact, post deregulation experience in the airline industry has revealed several elements of the structure of demand and supply conditions which conflict significantly with the conditions necessary for the pure theory and results of contestable markets to apply.

On the supply side, "sunk" costs have, on close examination proved a considerable barrier to entry. This has been the case largely because markets are vertically integrated in subtle ways. Take for example the case of People's Express as a potential aggressive entrant threatening the profits of established airlines. The shortage of gates and landing slots prevented the airline from acquiring even a single gate of its own at Denver's Stapleton International Airport, so it was forced to lease gates at non-competitive prices and at non-competitive times from other carriers. Such subtle sunk costs significantly limit the scope for potential competitors in airline markets (see Baumol and Willig (1986) for further details of this and related "sunk" costs in the airline market).

On the demand side, considerable effort has been made by established carriers to commit passengers to established carriers, both directly and via cornering sectors of the travel-agent market, and indirectly with huge advertising campaigns aimed at reputation building. We shall be examining these themes more closely in later chapters but for the moment we need only note that, to the extent that they work, they make price competition by entrants less effective, and the threat of entry a less effective discipline on incumbents behaviour.

Perhaps the most thorough examination of the effect of these issues was conducted by Bailey (1986). She subjected some of the testable implications of the contestable market theory to severe testing. In particular, she examined the situation that has emerged in the aftermath of deregulation in light of specific predictions of the theory : a variety of products will emerge, each of which will yield zero economic profit; the revenues from any subset of the products must exceed the incremental costs of those products, so that no cross - subsidy can exist; prices for each product will equal marginal costs; and an equilibrium market structure will minimize costs of the industry. Her evidence was not clear-cut - in some market segments (notably the long haul market), deregulation does appear to have brought with it cost efficiency and non-monopolistic pricing structure; nevertheless, in other market segments, notably short-haul national and regional routes, no such benefits were found.

In light of this, it is unsurprising that specific econometric studies have confirmed the imperfections of contestability of airline markets. Call and Keller (1984) show that there remains a significant positive correlation between profits and concentration in airline markets. Graham, Kaplan and Silbey (1983) find that, on average, prices deviate from costs by over ten percent on routes which use the major slot - constrained airports in New York, Chicago and Washington D.C..

These and related results in other transport markets suggest that, even in markets where the contestability assumption might <u>appear</u> to apply (which is a very limited sub-set of markets in the first place), closer examination reveals that deviations from the contestability assumptions occur which lead to refutations of the theory's prediction. This is not to deny that important differences in degree of contestability exist: Froeb and Geweke (1984) find that the aluminium industry approximates more closely to contestability than might have been expected; the work of Davies (1986) for the Canadian Transport Commission concludes that contestability theory may offer an interesting model for the liner shipping industry, given the transferability and resaleability of capital in ocean shipping. This suggests that the contestable markets theory, although not successful in justifying a grand presumption that forces of competition predominate, has succeeded in the more modest task of providing some insight into the working of competitive processes.

8.5 CONCLUSION

The conclusion of this review is that there may be limited scope for applying the strict version of the contestable markets hypothesis: few, if any markets meet the strict requirements of contestability. If most markets exhibit some degree of non-contestability there is considerable scope for strategic moves designed to gain a competitive edge over rivals. We examine these possibilities in the next chapter.

CHAPTER 9

STRATEGIC MOVES IN NON-CONTESTABLE MARKETS

9.1 INTRODUCTION

In this chapter we move from the contestable market assumptions and consider more complex market structures. In particular we examine markets where technology may be specific to certain firms and where additional expenditure on technology may involve costs for the firm which are sunk over some part of the production cycle. In addition we now assume markets where information is less than perfect, and indeed this information may be asymmetrically distributed between economic agents.

Having defined under Section 9.2 exactly what we mean by a "strategic" move under such market conditions, using as our starting point the work of Schelling (1960), we go on to apply this definition to specific examples of strategic moves by firms which are taken with a view to gaining a competitive market advantage. Section 9.3 discusses the importance of sunk costs in this process, while Sections 9.4 and 9.5 examine how, by committing resources to productive capacity, advertising, and research and development, firms may be able to alter competitive conditions to their advantage. In some cases the power of these strategic weapons may be such as to ensure complete market dominance by eliminating all competition; in other cases while these weapons cannot guarantee complete market dominance, they can still ensure a competitive advantage over market rivals. Section 9.6 further complicates the analysis by introducing uncertainty into the picture.

The focus of Sections 9.3 to 9.6 is on the single product firm operating in a homogeneous, but non-contestable market. In Section 9.7 and 9.8 we examine the nature of strategic moves open to the multiple product firms. Section 9.9 explores how firms can use the legal and regulatory framework to sustain their competitive advantage. We conclude that, in stark contrast to the discussion in Chapter 8, there are a host of strategic moves open to the individual firm when market conditions are non-contestable.

9.2 THE NATURE OF A STRATEGIC MOVE

The formal analysis of strategic moves in Economics has its foundations in research into the theory of rational choice in complex decision making situations. The basic neoclassical theory of consumer choice was designed to explain those decisions where the consumer could be considered to have a well-defined set of preferences and to be subject to well defined market constraints. By the late 1950's, economists had realised that there were a wide variety of choice situations in which the above paradigm seemed to be inappropriate. On the one hand some economists, for instance Simon (1959), thought the theory assumed "too much" of the average economic agent, and this line of reasoning led to what we now call theories of "bounded" rationality which we have already encountered in Williamson's work on markets and hierarchies. On the other hand some economists, for instance Elyster (1979), thought the theory assumed "too little" of the economic agent and that there were many situations where agents might behave much more subtly than the theory suggests. This line of reasoning lead to what we now call theories of "binding" rationality. The nature of a strategic move has its roots in this latter theory of economic behaviour.

The theory of "binding" rationality is designed to come to grips with the phenomenon that a person in evident possession of his faculties, and knowing what he is talking about, will, in some circumstances, seek to prevent, to compel, or to alter his own later behaviour - to restrict his own options in violation of what he knows will be his preferences at the time the behavior is to take place. The mythical case of such a problem is well illustrated by Ulysses and his encounter with the Sirens - it will be remembered that, in the myth, Ulysses takes a deliberate self-denying move (tying himself to the ship's mast), as a means to avoid being lured (willingly) to his death by the sound of the Sirens. There are many modern-day analogies to the problem faced and solved by Ulysses - the person who relinquishes authority of his car keys to another person before he goes drinking is one obvious example.

The key feature of this class of problem seems to be the interaction within the individual of alternating sets of preferences but where only one set of preferences appears to be the authentic representation of his values. The way the "straight" self imposes itself on the "wayward" self is through a policy of self-denying actions. Such actions are termed strategic moves in the theory of binding consumer choice. Another way of putting this would be to say that the individual treats himself both as principal and agent (to use the terminology of Chapter 4), recognizing that he occasionally may be a servant who might misbehave - as principal, he undertakes strategic moves designed to alter the behaviour of himself as agent.

Shelling (1960) extended this theory of strategic interaction amongst sets of preferences to situations involving interactions between different individuals. In such a context, Shelling defines a strategic move between two individuals as an action "that influences the other person's expectations of how one's self will behave". The success of a strategic move in such circumstances will depend not just on communicating how one intends to behave, but on persuading the other party that this really is how one will behave in future circumstances. One of Shelling's key insights was to realize that the solution to this problem of persuasion was similar to the problem faced by Ulysses: "Other people are more easily persuaded if one has already undertaken an irrevocable commitment which makes the threatened behaviour coincide with the action that best promotes one's own interest, were the specified situation to occur. The essence of these tactics is some voluntary but irreversible sacrifice of freedom of choice. They rest on a paradox that the power to constrain an adversary may depend on the power to bind one's self; that, in bargaining, weakness is often a strength, freedom may be a freedom to capitulate, and to burn bridges behind one may suffice to undo an opponent" (Shelling 1960, p.22).

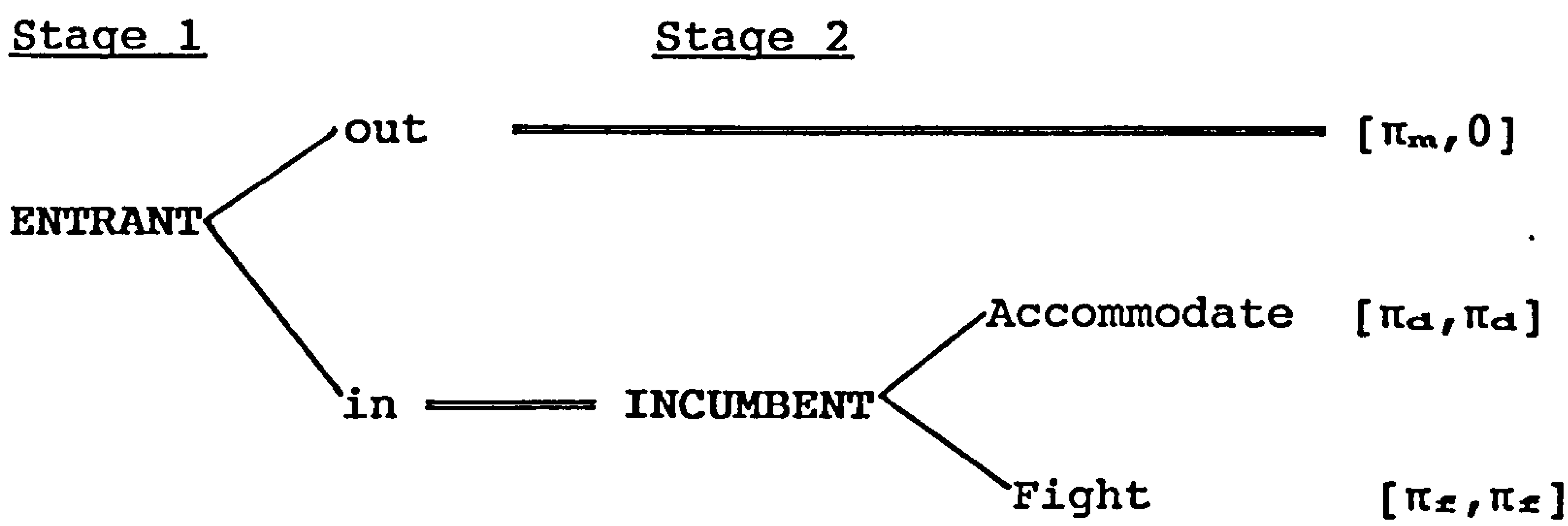
The paradox here is highly subtle, an irrevocable pre-commitment leaves one with no other rational choice than to carry out one's threat if the specified situation occurs, even though, given these circumstances, one might now regret having made the pre-commitment. Shelling's book discusses a wide variety of political and economic applications of this principle. For our purposes, we are interested in ways to gain a competitive advantage over market rivals. Many suggestions have been made in the economic literature as to how this might be done: investment in productive capacity, advertising, brand proliferation, product and process innovation, to name but a few. We will examine the efficiency of these actions in the following sections.

9.3 SUNK COSTS AND COMMITMENT

We saw in Chapter 8 that the problem for a firm wishing to sustain a competitive advantage in a contestable market is that its behaviour may be replicated by a potential entrant. Strategic behaviour designed to sustain a competitive advantage is, in essence, behaviour which makes such replication either impossible or undesirable. When the contestable market assumptions break down, such strategic behaviour becomes very plausible as we shall now examine. In order to bring out most clearly the underlying logic behind strategic behaviour, it will be useful to analyse carefully a simplified theoretical model first brought into the industrial economics literature by Dixit (1982). His particular concern was to examine the antitrust implications of non-contestable markets. Our concern is rather different as we focus on the competitive advantage implications of non-contestability.

Assume an incumbent monopolist presently earns monopoly profits π_m in a market, but is threatened with the possibility of entry. If entry occurs, one of two things will happen. Either the two will subsequently collude and divide the monopoly profits between each other, each earning π_d or they will fight a price war with disastrous results for both. Figure 9.1 captures the dynamics and payoffs of this simple game, assuming $\pi_m>\pi_d>0>\pi_f$

FIGURE 9.1



How can the monopolist sustain his market advantage in this framework? Possibly he could communicate his willingness to fight should the entrant decide to enter the market. The entrant might think the following: if I stay out of the market, I will earn zero profits; whereas if I enter the market, I will earn negative profits; so my best strategy is to remain out of the market and leave the incumbent with his market dominance.

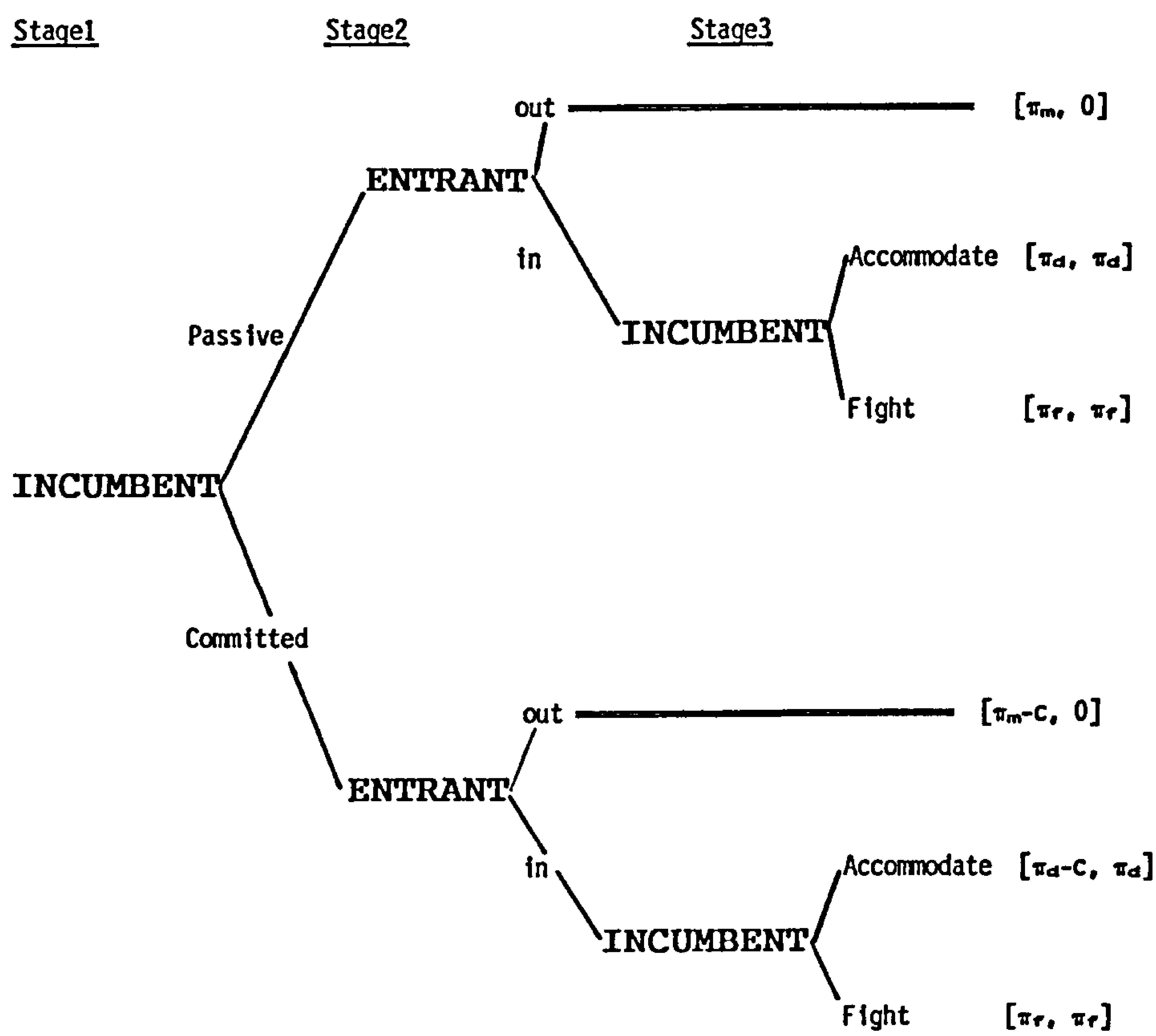
Notice that the strategy pair (Do not enter, Fight if entry) constitutes a Nash non-cooperative equilibrium for the game (a Nash non-cooperative equilibrium is defined as an equilibrium where each individual game player is taking an optimal strategy for himself given the set of strategies of the other player in the game). In our case, given the strategy of the monopolist, the best thing for the entrant to do is to abstain from entry; and given the strategy of the entrant, the monopolist can happily threaten a price war he is never actually going to carry out.

However, does the Nash equilibrium above provide a convincing account as to the likely evolution of the game? The answer surely is no. For the entrant to believe the monopolist's threat to fight would involve the entrant attaching credibility to a threat which the monopolist has no incentive to implement: if the bluff is called the optimal strategy of the monopolist must be to share market profits, as indicated in Figure 9.1 The threat "Fight if entry" is not a credible threat in this game.

In the language of game theory, the strategy pair (Do not enter, Fight if entry) is not a perfect equilibrium for the game. A perfect equilibrium requires that a strategy chosen by any player must be optimal if that stage of the game is actually reached. Thus a perfect equilibrium rules out non-credible threats. If we insist that any proposed solution to the game above must constitute a perfect equilibrium, it follows that the only solution must be (Enter, Accommodate).

Thus, as the model stands, there is apparently nothing the monopolist can do to maintain his market advantage. However, the model is unduly simplistic and restrictive because the incumbent is given no means by which the entrant can be influenced prior to entry. Let us assume instead that the market in which the incumbent enjoys his market power is non-contestable : specifically, let us assume that there are sunk costs involved in production. Remember a sunk cost is one which is not instantly reversible or transferable to another market.

FIGURE 9.2



In Figure 9.2 we have augmented the game in Figure 9.3.1 to allow the monopolist, if he so wishes, to "commit" himself to a strategy of investing in excess sunk capacity, in readiness to fight a price war. Intuitively we can think of this as our monopolist producing an output which involves leaving part of his capacity idle. Assume that our potential entrant can see this and will thus know that, in the event of entry, the monopolist has the machinery at hand to enable him to increase market output quickly and hence drive market prices down. What will our entrant do now? Let us solve for the perfect equilibrium.

Go first of all to stage 3 of the game. If the incumbent has not previously committed himself to the excess capacity strategy and entry has occurred, the optimal choice for the monopolist is to accommodate. If, however, the monopolist has previously committed himself to the excess sunk capital expenditure, and the potential entrant has subsequently entered, the incumbent will accommodate only if $\pi_a - c > \pi_f$. Otherwise he will fight. Thus, at stage 3, an uncommitted incumbent will accommodate, whereas a committed incumbent will fight if $\pi_a - c < \pi_f$.

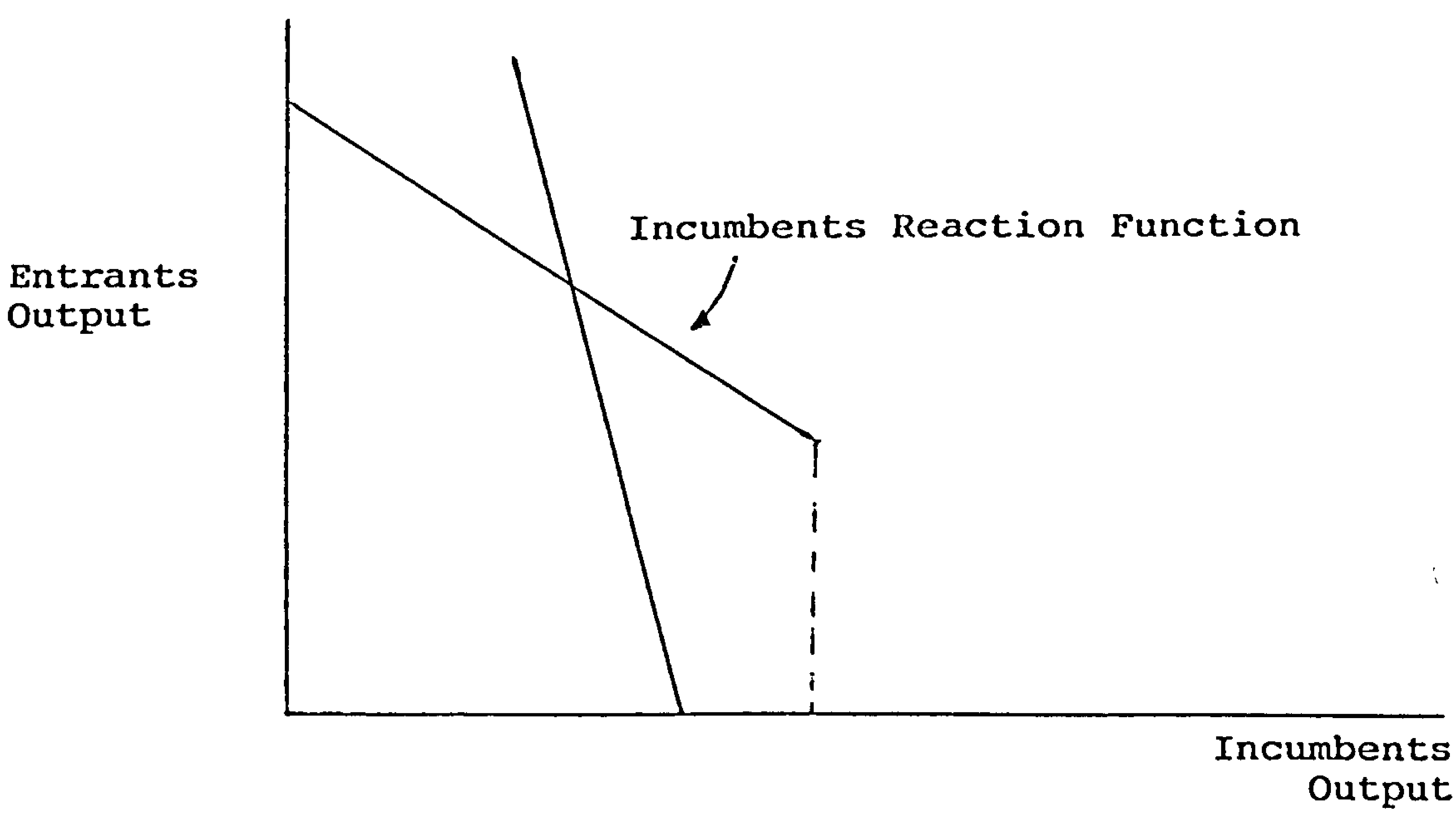
Now go back to stage 2 of the game. Will the entrant enter the market? Once again, applying the logic of a perfect equilibrium, the potential entrant will enter if either the monopolist is uncommitted or if the monopolist is committed and $\pi_a - c > \pi_f$. However, if the monopolist is committed and $\pi_a - c < \pi_f$, the entrant will not enter the market, preferring zero to negative profits. Finally, let us go back to stage 1 of the game. Will the incumbent commit himself to the strategy of excess investment? The incumbent has the choice of remaining passive, in which case he will observe entry and subsequently earn profits π_d; or if committing himself, in which case, if $\pi_d - c < \pi_f$, he can enjoy profits of $\pi_m - c$. Again applying the logic of the perfect equilibrium, he will commit if $\pi_m - c > \pi_d$. Thus if $\pi_m - \pi_d > c > \pi_d - \pi_f$ the monopolist can commit himself to an aggressive excess capacity strategy which successfully deters entry. The monopolist's threat of a price war is now a credible threat.

9.4 FURTHER ASPECTS TO COMMITMENT

The previous section outlined, in simple game theoretic terms, the possible role for a commitment instrument as a means to gaining a competitive edge over potential rivals. The approach, however, did not really come to grips with the economics of the issue - the incumbent firm merely faces a dichotomous choice of whether or not to commit resources to an entry-deterence strategy. In practice, the firm has a wide range of possible levels of commitment in one or more strategic instruments, and post-entry interaction can assume a wide variety of forms, from complete collusion to complete price warfare. The question naturally arises as to the nature of strategic commitment to gain a market advantage in this more complex world.

Once again, we owe it to Dixit (1980) that these issues are addressed in a rigorous theoretical manner. The approach has been developed by, among others, Dixon (1985). To illustrate the complex issues involved, consider the reaction curve diagram pertaining to a post-entry duopoly that is Cournot in nature (for a definition of Cournot equilibrium, see Chapter 7). That is, the reaction curve for each firm plots its optimal output given the rival's output on the assumption that, as one firm changes its output, the other firm maintains its existing output constant. Figure 9.3 plots the relevant reaction curves.

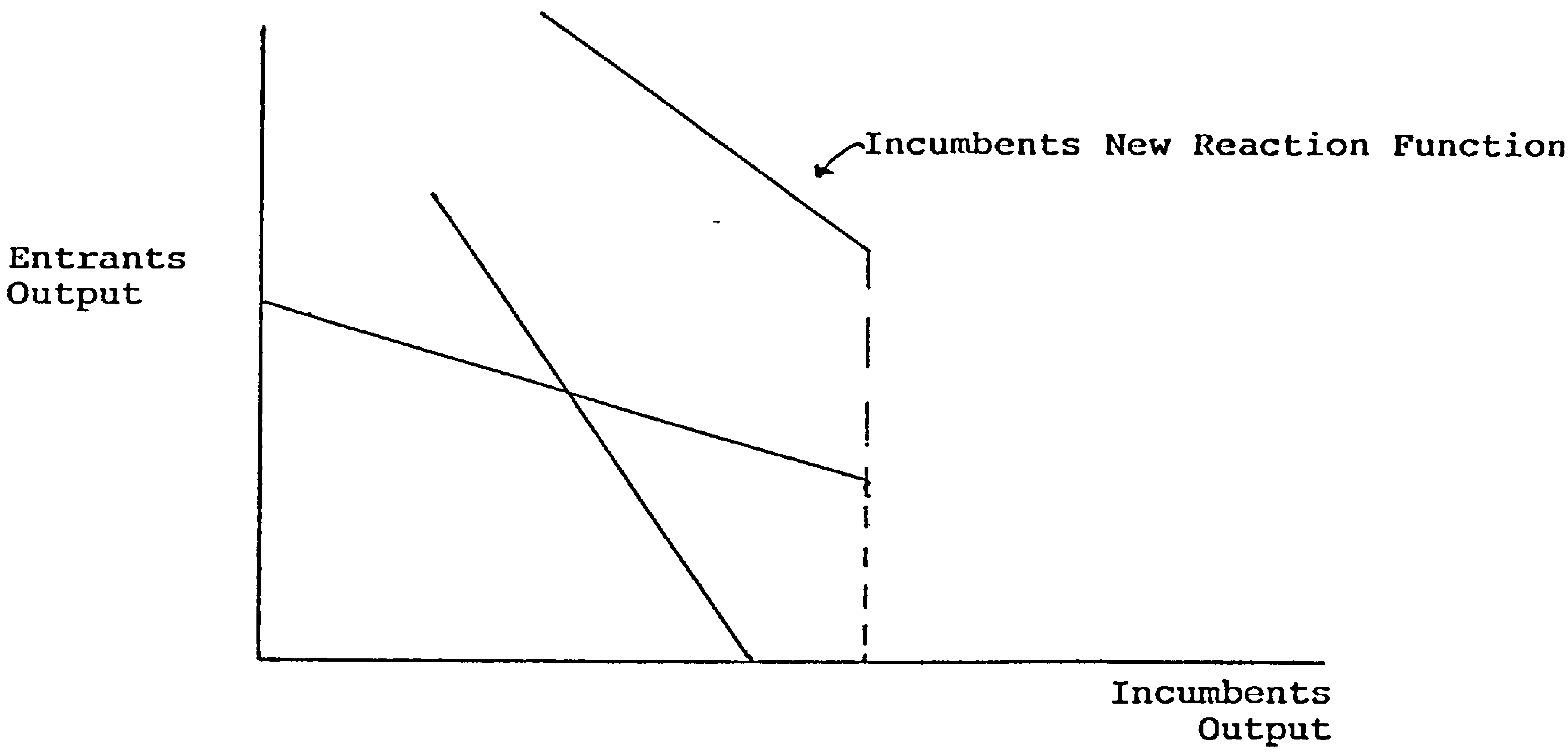
FIGURE 9.3



One key point to note about Figure 9.3 is that, in contrast to the simple Cournot approach to oligopoly where the reaction functions are continuous, the reaction functions drawn here are discontinuous. The reason for this is that economies of scale dictate that if, for example, Firm A (the incumbent) produces an output greater than OB, the entrant's expected profits (under the Cournot assumption) are zero or negative.

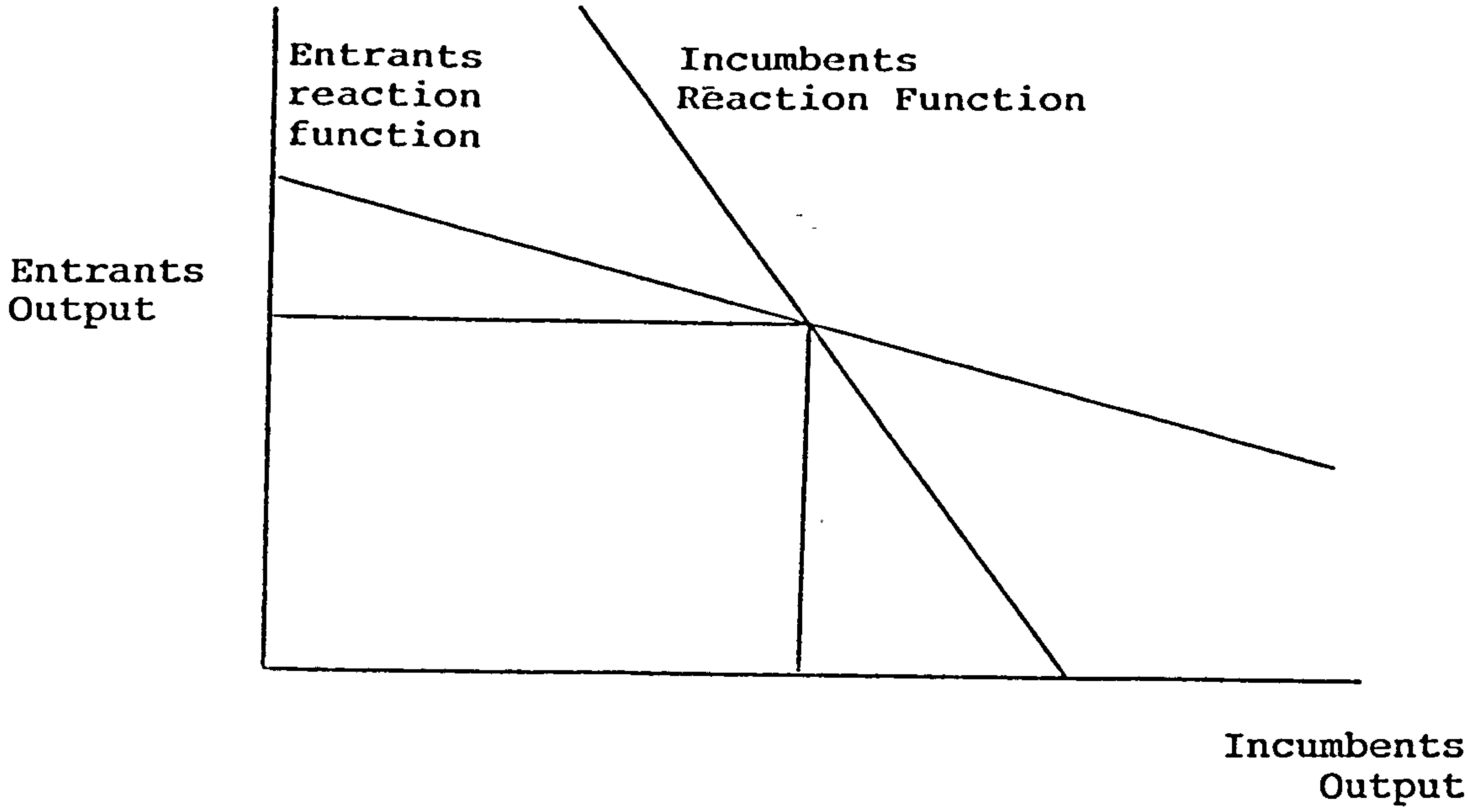
In the absence of sunk costs, the entrant will rationally expect the post entry oligopoly equilibrium to be at point C, and entry will not be deterred. Imagine now, however, that there are sunk costs of production in this duopolistic market. The incumbent, may well be able to commit himself in such a way that his effective post entry marginal costs are lowered. The effect of doing this in terms of figure 9.3 is to shift the incumbent's reaction curve to the right, as is illustrated in figure 9.4 below. The intuition behind this shift is that, for any given level of expected marginal revenue, the lower marginal cost encourages a higher output (since profit maximisation dictates that output is expanded until marginal cost equals marginal revenue). Now, faced with this reaction function, if the incumbent chooses to invest in capacity sufficient to produce output OB, the entrant will no longer expect to be able to make profits in the event of entry. The strategic investment effectively impedes entry, as there is no Cournot - Nash equilibrium which involves both firms producing in the market.

FIGURE 9.4



The key issue of the Dixit (1980) model is that it reveals clearly that, as he put it, "the role of an irrevocable commitment of investment in entry deterrence is to alter the initial conditions of the post entry game to the advantage of the established firm, for any fixed rule under which that game is to be played " (1980, p.106). The exposition above has illustrated the extreme case where the investment is sufficient to deter entry completely. The monopolist would have the incentive to carry out this investment in sunk capacity if the profits from so doing (the profits associated with output OB), exceed those from Cournot duopoly. Even if this is not the case, however, the monopolist may very well have the incentive to undertake some strategic investment. By means of irreversible investments, the incumbent can sink some of his marginal costs prior to an entry threat, and so reduce his effective marginal costs relative to an entrant's (thus shifting his reaction function to the right). Even if the strategy does not fully deter entry, since in most oligopoly models firms with lower marginal costs end up with higher market shares, the ability to act strategically is a clear route to gaining and maintaining a competitive advantage. In terms of figure 9.4, the monopolist clearly has the incentive to sink some of his marginal costs and thus shift the reaction function to the right so long as the marginal net benefit of so doing is positive (the increase in profit from so doing, relative to the no strategic investment Cournot equilibrium at C) exceeds the investment cost of the strategic investment. A plausible equilibrium would be at point C' as in figure 9.5, with the incumbent enjoying the lion's-share of industry profits.

FIGURE 9.5



Notice in Figure 9.5 that the monopolist is not investing in excess capacity as an entry deterrent strategy: rather he is investing in capacity which he is actually using to produce output. Only if the post entry game is so competitive that the incumbent is expected to increase output in the event of entry will excess capacity be a sensible strategy. To emphasize the point again, however, this does not mean there is no room for strategic investment where the post entry game involves some reduction in output by the incumbent (as in Cournot oligopoly or collusive oligopoly) the difference in these cases is, however, that the strategic sunk cost investment is designed not necessarily as an entry deterrent, but as a means to gaining a competitive advantage in the post-entry market, by reducing post entry marginal costs relative to those of competitors.

To conclude then, investment in capacity might be an instrument of strategic importance to firms. If the rival were to enter the market currently dominated by the incumbent, a duopolistic equilibrium would result. The nature of that equilibrium would depend partly on the incumbent's cost curve - and hence the investment in capacity - that the incumbent makes prior to the rivals entry decision. The larger his investment, the less attractive is the prospective duopolistic equilibrium for the rival. The argument here has been conducted in terms of investment in productive capacity, but the argument is equally as valid for the case of strategic investment in research and development, as is detailed by Brander and Spencer (1983). Further Salop and Scheffman (1983) show that rather than lowering his costs relative to an opponent's as a means towards gaining competitive advantage, a viable alternative may be to raise a rival's cost - the classic case of this would be where the incumbent can deny a rival interconnection to his (ie. the incumbent's) network on fair terms, an argument that, for example, Mercury has used about its competitive dealings with British Telecom. Furthermore, though we have concentrated on the manipulation of costs as a means towards gaining competitive advantage, firms may well be able to manipulate demand conditions to the same effect. Heavy advertising by an incumbent has the effect of creating a stock of goodwill for the advertiser shifting his demand curve out to the right and thus increasing his sales (and decreasing those of a rival) for any given industry price. This stock of goodwill is a sunk commitment which will depreciate only slowly over time, thus again advertising can act as a strategic weapon this time, altering future demand conditions in the industry. However, the subtleties of advertising raise difficult questions when considering competitive advantage, and it is to these and related issues that we turn in the next section.

9.5 THE FAT CAT EFFECT, THE PUPPY-DOG PLOY, AND THE LEAN AND HUNGRY LOOK

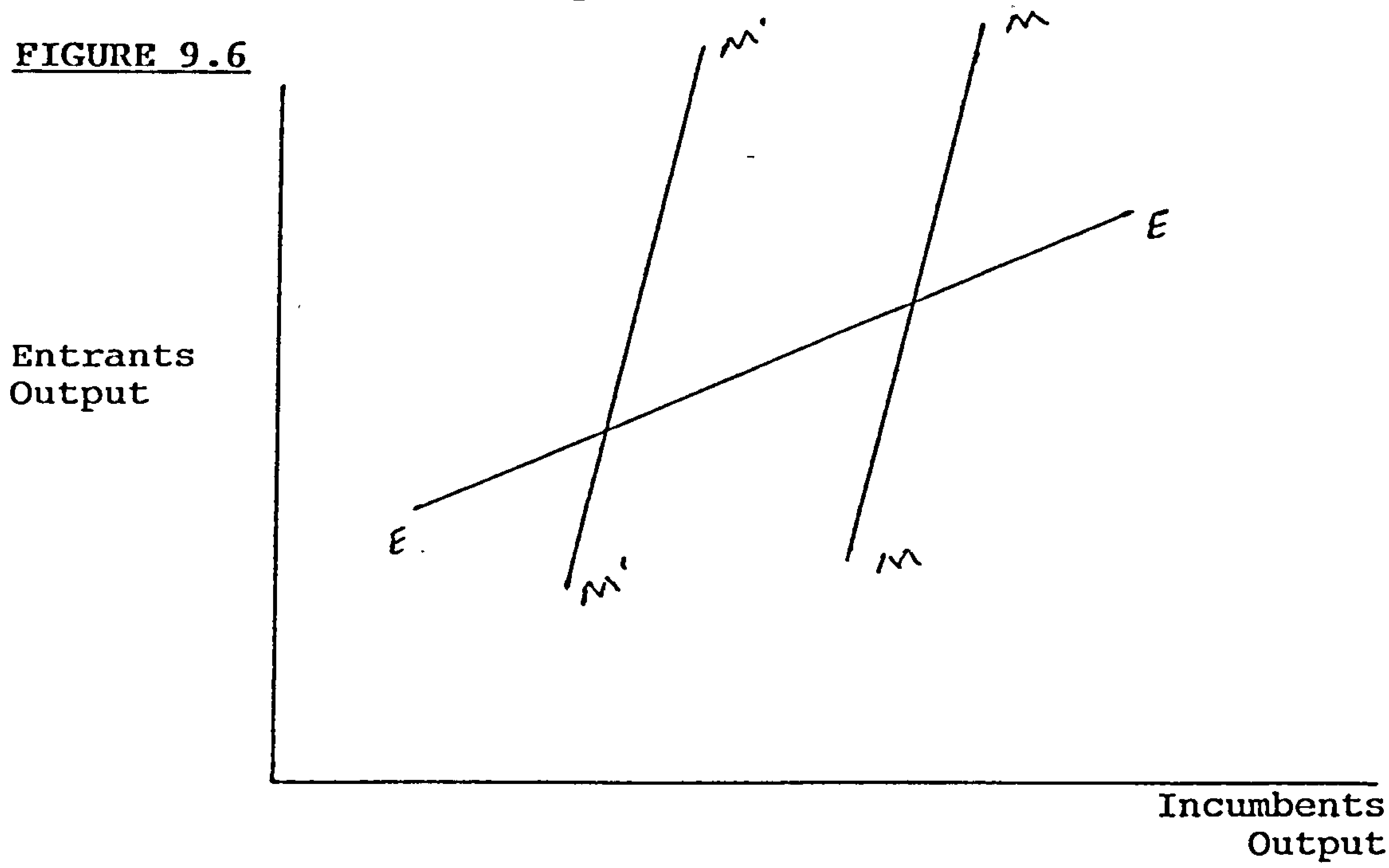
The strategic moves analysed so far have emphasized over-investment compared with that which would take place were the incumbent not threatened by actual or potential rivals in the market place. However, this need not always be the case - Fudenberg and Tirole (1984) present a taxonomy of strategic investment possibilities using a zoological analogy. This taxonomy places the strategic investments made by firms into four categories.

The example of overinvestment we have examined in 9.3 and 9.4 above are referred to by Fudenberg and Tirole as "Top Dog Tricks" - overinvestment makes the incumbent tougher in the post entry game, reducing the potential entrant's expected payoff and so reducing the entry threat. The "top dog" is always willing to fight to defend his market position. As we analysed in 9.4 the crucial role of the irrevocable excess capacity is to alter the initial conditions of the post entry game to the advantage of the established firm, for any rule under which the game is to be played. In 9.4 we assumed that the rule in question was Cournot in nature - this gave us the backward sloping reaction curves of Figure 9.4

However, Cournot competition is a special, and arguably unlikely oligopolistic interaction. Other forms of rivalry, such as some forms of price competition, lead to quite the opposite reaction such that, for example, a lower price by one firm induces rivals also to lower their prices. In such cases, reaction functions slope upwards and if entry cannot be prevented, a policy of high investment would lead to an aggressive entry by market rivals to everyone's disadvantage. In fact, rather than excess investment being the optimal strategic policy for the incumbent, a deliberate policy of <u>under</u> investment may be the appropriate strategic choice, by reducing the vigour of the inevitable post-entry competition. Such strategic underinvestment is referred to as a "puppy-dog ploy" by Fudenberg and Tirole.

We can illustrate the puppy-dog ploy using conventional reaction functions, which we now assume to be upwardly sloping as in Figure 9.4 because, for example, post-entry conditions are price-competitive.

FIGURE 9.6



Underinvestment shifts the incumbent's reaction function to the left and is shown to reduce the output of both firms nearer to the joint profit maximising level. As a consequence, both firms earn higher profits than if aggressive price competition dominated the post entry game. Of course, it must be emphasized that, to be convincing, such underinvestment must be credible in the sense that it must not be easy to increase investment at a later date and so get drawn into a price war. This is perhaps easier to imagine where there are long lags associated with any investment policy. This strategy of minimizing the damage of entry by turning the incumbent into a "small, friendly, non-aggressive puppy-dog" is desirable if investment makes the incumbent look tougher, and the post entry reaction curves slope upwards. The puppy-dog understands the danger of fighting and prefers to minimize the potential damage.

When we examine more carefully the various types of strategic weapons available to firms, as opposed to the physical quantity of investment in any one weapon, further strategic possibilities emerge. In all the examples discussed to date, extra investment makes the incumbent look tough, that is to say that high levels of investment make the incumbent more likely to act competitively post entry, while low levels of investment lead, other things being equal, to less competition. The most obvious practical example of this, as we have emphasized, is investment in sunk capacity. However, as Schmalensee (1983) has emphasized, there are other types of investment, such as advertising (and possibly R&D), which make the incumbent "soft", meaning by this that high levels of advertising can make the incumbent less likely to act vigorously post-entry, while low levels of advertising may make him hungrier for competition.

In Schmalensee's model, a customer can buy from a firm only if he is aware of its existence. To inform consumers, firms in the market place advertisements in newspapers. An advertisement that is read informs the customer both of the existence of the firm and of the price charged by the firm for the good in question. In the first period, only the incumbent is in the market; in the second period the entrant may enter. The crucial assumption made by Schmalensee is that, because of inconvenience costs, some customers who have read the advertisement issued by the incumbent will not take the trouble to look at further adverts in the second period, and therefore buy only from the incumbent. In essence, by investing in the first period, the incumbent accumulates goodwill in the form of a captive market for his product.

In this environment, advertising affects actual and expected profits of the incumbent in subtle ways. There is obviously the direct effect that an increase in advertising has on the size of the captive market and hence on first and second profits. Less obvious, however, is the fact that the larger the incumbent makes his market share through advertising, the greater to him is the cost of price competition if entry occurs; and hence, if he expects post-entry competition to be price sensitive, high degrees of advertising lowers his credibility in issuing price threats to deter entry. Thus, <u>low</u> advertising can increase the credibility of a price and so help to deter entry. Schmalensee shows that, in quite plausible cases, the strategic effect of low advertising that raises the threat of a price war can outweigh the direct effect of low advertising increasing the entrant's expected market share.

Overall, the entrant's expected profitability may be reduced by the incumbent remaining "lean and hungry". Thus, what, Fudenberg and Tirole refer to as the "lean and hungry look" of underinvesting in advertising can lead to credible entry deterrence. Fudenberg and Tirole also show that a similar strategy may be available with technological competition.

Even now we have not yet exhausted the taxonomy of strategic initiatives open to the firm in complex market conditions. The final category of strategic investment analysed by Fudenberg and Tirole is referred to as "Fat Cat Effects". Continuing with the advertising example, let us now assume that the nature of the second period reaction function is such that entry is inevitable. In this case, the incumbent no longer has a strategic incentive to signal that pure competition will be fierce, since the inevitable price war will benefit no one. Here the incumbent has the incentive to signal the opposite, that he is a cuddly, pacifistic "fat cat" who does not want to fight a price war. Thus, when entry is inevitable, both the direct effect that an increase in advertising has on the captive market and the indirect strategic effect of reducing the incentive for a price war argue for <u>over</u>-investment in advertising to cushion the blow of entry.

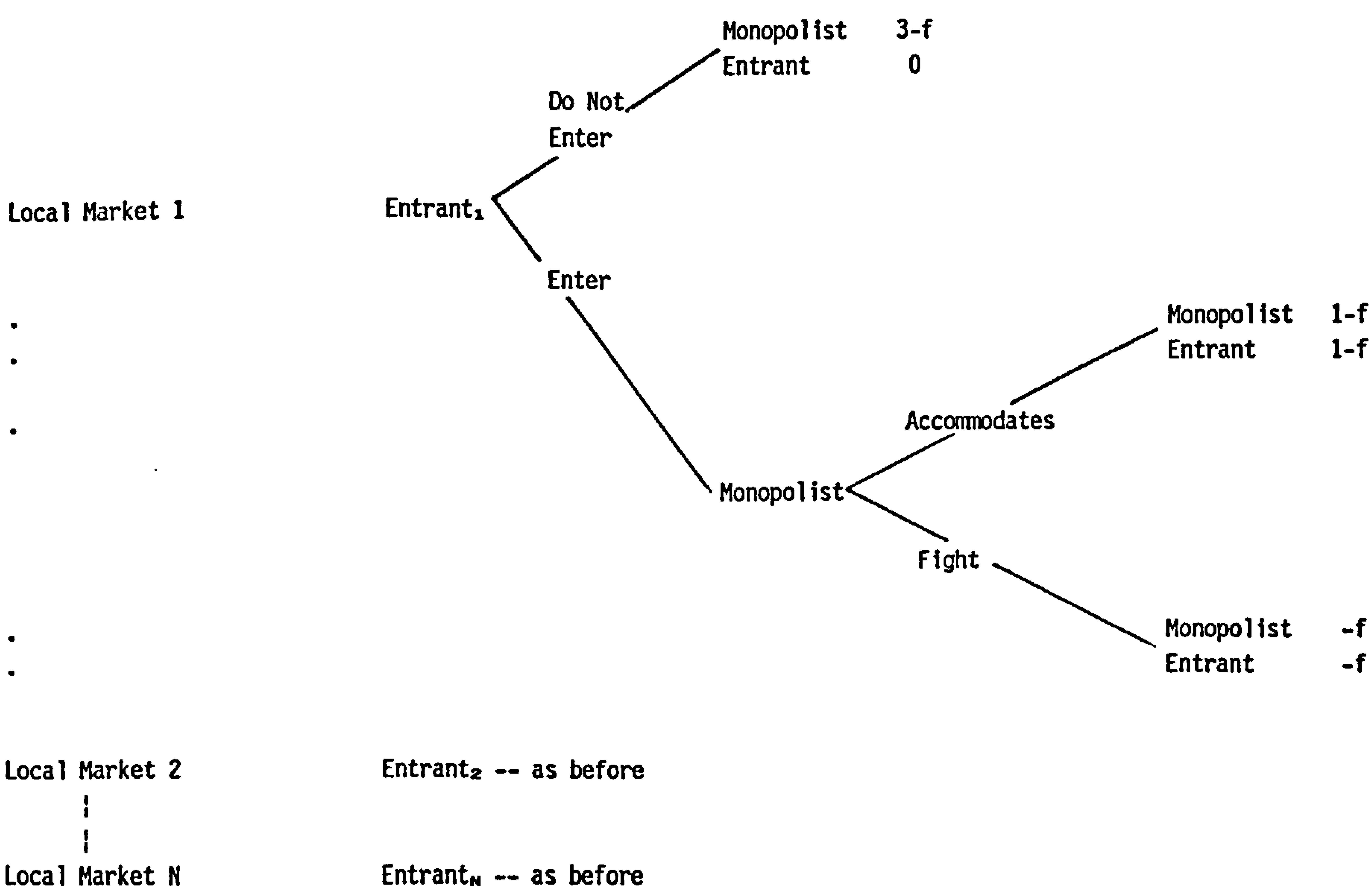
To summarize, this taxonomy of strategic moves illustrates some of the complexities of economic life - though in the next section we shall have to make things even more complex! We have highlighted three important factors in determining the nature of strategic investment. First, it can make a significant difference to a firm's behaviour whether or not it believes that a rival can be deterred from entering the market (for example, compare the incentive for "lean and hungry look" and "fat cat" strategies). Secondly, the nature of post entry competition, especially with regard to the likely degree of price competition, can alter the incentives for aggressive strategic investment (for example, compare the arguments for "top dog trick" as opposed to "puppy-dog ploys"). Thirdly, certain types of investment (eg. physical capacity) make a firm tough (more aggressive) when it comes to price competition, whilst other investments (eg. advertising) can make a firm soft (less aggressive) in the same circumstances. These conditions help to emphasize the subtleties of strategic behaviour designed to maintain a competitive advantage.

9.6 REPUTATION AND UNCERTAINTY

The discussion so far has implicitly assumed that each firm has perfect knowledge not just about its own costs, but also about those of its rival, and about market demand conditions. Further, to date we have considered only once-for-all strategic moves, and have not addressed those situations where there is scope for a sequence of strategic moves over time. In the language of game theory, we have not yet analysed the scope for strategic moves in a repeated game framework under conditions of uncertainty. As we shall see, when we do consider such a game framework, there are new possibilities for strategic moves designed to gain and maintain a competitive advantage over market rivals.

These issues were first formally addressed in an economic context by Kreps and Wilson (1982), and Milgrom and Roberts (1982). The key insight of these authors can best be understood by considering a game with a similar structure to that in section 9.3 of this chapter - only now we allow both for the possibility that the game will be repeated and for the possibility of imperfect information flows between the market participants. Imagine a situation where a market leader has a series of chain stores in different towns within a country. Assume that in each town, he faces potential competition from one local store. In this situation, the competitive interaction between the chain store and the local store in one town might be expected to affect the subsequent competitive interaction between the chain store and the other local stores in different parts of the country. To clarify this intuition, consider the specific game in Figure 9.7 below. One monopolist (the chain store) interacts with N local traders sequentially over N time periods. At each play of the game, one of the local stores must decide whether or not to challenge the chain store in the local market, and the chain store must decide what to do about such competition if it actually occurs. The precise payoffs are outlined in figure 9.7

FIGURE 9.7



Note: f can be considered as a fixed cost with $0 < f < 1$. It can be seen that this game structure resembles that of section 9.3, with monopolistic profits arising if there is no competition, with positive duopolistic profits arising if there is accommodation, duopoly, and with negative profits arising if there is price-war duopoly.

How will this game evolve if the various economic agents interact rationally? In particular we are interested in knowing if by strategically acting in a certain way in one local market, the chain store can affect subsequent behaviour in other local markets to his own advantage. Again we address this issue using the perfect equilibrium concept developed in section 9.3.

Suppose first of all that the game is played a fixed, finite number of times, with full information on the pay-offs of the game available to each player. In this case, the perfect equilibrium will have entry and accommodation at each play of the game. The proof of this surprising result is as follows. At the last play of the game between the chain store and local store N, entry and accommodation is optimal for the reasons outlined in Section 9.3, and so the perfect equilibrium must involve this strategy pair. Going back to the penultimate play of the game, with the chain store and local store N-1 both knowing how the last play of the game will in fact evolve, the perfect equilibrium must again involve entry and accommodation - there is no incentive for either to pursue any other strategy. By induction we can repeat this argument right back to the first play of the game, and so can conclude that entry and accommodation must characterise each step of this multi-period game. This game theory result was first obtained by Seller (1975) and goes contrary to intuition which might have suggested that the monopolistic chain store would fight in early plays of the game to gain an aggressive reputation which might deter future local stores from entering their local markets. However, as we shall see, the insight of Kreps and Wilson (1982) was to point out that when the above game is played under conditions of uncertainty, there is scope for the chain store to strategically operate in some local markets to gain a reputation which will deter other rivals in other markets.

There are several ways we might introduce lack of perfect information into the above game. We might, for example, simply assume that local stores do not have full information about the chain store payoffs under the various possible outcomes of the game and / or vice versa. However, the easiest way to introduce uncertainty into the above game is simply to assume that the series of potential entrants are unsure at the start of the game if the chain store is game theory rational (and hence will choose his strategy using the notion of perfect equilibrium) or is a "thug", preferring to fight wherever he gets the chance (whether or not this is game theory rational), perhaps in deference to some self-imposed market share goal. The essence of the perfect equilibrium in this game can be grasped by collapsing the number of plays to two, and thus considering the situation of a chain store playing the game outlined in Figure 9.7 in two different local towns against two local businessmen. Assume that, before the game evolves, each of the two businessmen attaches a prior probability Ω to the possibility that the chain store is a "thug", and thus will always fight entry. We can construct the perfect equilibrium by considering the optimal strategy for each agent of the game under the various possible situations which might arise, again solving the game "backwards".

Consider now the dilemma faced by the second local merchant (leader) whether or not to enter the second local market. This second entrant will have observed the evolution of the first play of the game, and this first play will crucially affect the decision of the second entrant. We can see that three things might have been observed by the second entrant at the first play of the game - the first entrant may simply have stayed out, there may have been entry and accommodation, and finally there may have been entry followed by a price war.

If there has been no entry at stage 1, the second entrant can infer nothing about the behaviour of the chain store. He is left with his prior probability Ω that the chain store is a "thug". Assuming the second entrant is risk neutral he will enter his local market if the expected profit from so doing exceed the profits from staying out of the market, i.e. he will enter if:

$$-f\Omega + (1-f)(1-\Omega) > 0$$

$$\text{i.e if } \Omega < 1-f$$

If this condition is not fulfilled, he will prefer to stay out of the local market.

However, if there has been entry followed by accommodation at stage 1 of the game, the second entrant's behaviour will be governed by different considerations. The observation that there has been accommodation at stage 1 of the game immediately alerts the second entrant to the fact that the chain store cannot be a thug (because the thug always fights). Knowing this, the second entrant realizes that if he enters the local market, the chain store will respond by accommodating, which will ensure positive profits for the local businessman. Hence, in the case where the second entrant observes accommodation at the first play of the game, he will respond by entering at the second stage.

Finally, the second entrant may have observed entry followed by fighting at the first stage of the game. What should he do in this case? He knows that this fighting may have taken place because the chain store is a thug, or because a game theory rational chain store was trying to bluff him into thinking the chain store is a thug, or at least re-assess the probability that this is in fact the case. If the second entrant is rational, he will reassess the probability that the chain store is a thug using Bayes Theorem. Using F to denote "fighting", S to denote the strong monopolist, and W to denote the "weak" game theory rational chain store we have :

$$P(S/F) = [P(F/S)\ P(S)] \ / \ [P(F/S)P(S)+P(F/W)P(W)] =$$

$$[1*\Omega] \ / \ [1*\Omega + (1-\Omega)X] \quad \text{where } X = P(F/W) \text{ (Bayes Theorem)}$$

When the second entrant has calculated this probability, he simply re-calculates the expected profits from entry using this revised probability, and, if these expected profits are positive, he will take the gamble that a weak monopolist has been trying to bluff him and so will call the weak monopolist's bluff by entering the second local market.

We can see that one element in this calculation is P(F/W). Let us go back one stage in the game now and consider the chain store's discussion whether or not to fight at stage 1 of the game. Obviously, if the chain store is a thug, it will fight regardless. The game theory rational chain store must, however, calculate the optimal value of X=P(F/W) before it can decide whether or not to try to bluff the second entrant by fighting first.

The calculation of this optimal X is, in reality, a complex task, but we can build up a solution heuristically as follows. What we do is to consider a weak monopolist's expected returns from an X which deters entry, and an X which does not. Consider first an X which does not successfully deter entry. From above we have :

$$\text{if } X > \Omega f \ / \ [(1-\Omega)(1-f)] \text{ then entry}$$

which will give expected returns of :

$$-f(X) + (1-X)(1-f) + (1-f) = 2(1-f) - X$$

The explanation of this expression which is a decreasing function of X is that in the first play the monopolist fights with probability X and hence has expected returns from stage 1 of $-f(X) + (1-X)(1-f)$. However, this strategy does not deter the second entrant who enters, in response to which the weak monopolist must accommodate, earning profits of $(1-f)$.

Consider now an X which does successfully deter entry. We know that if :

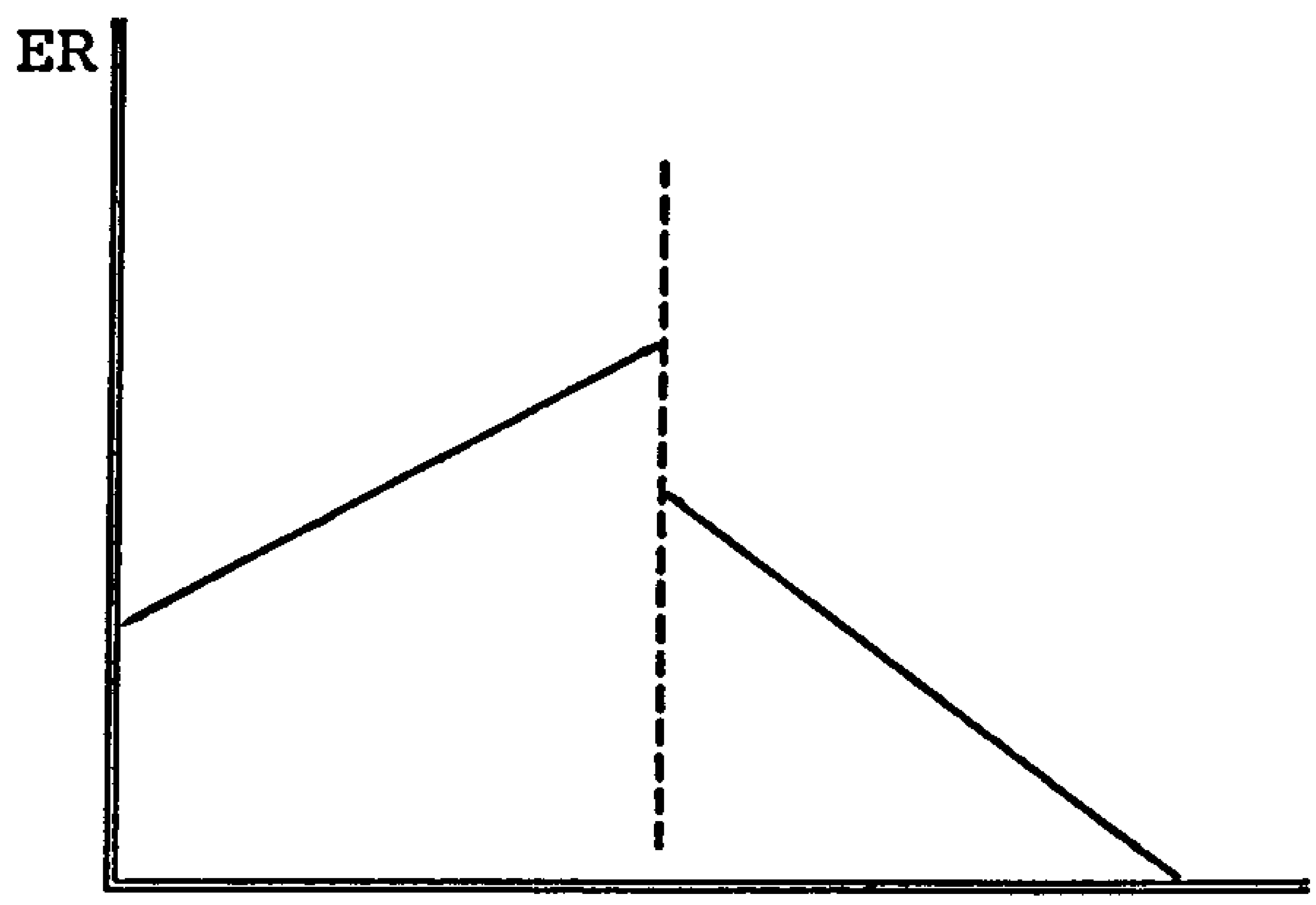
$X < \Omega f / [(1-\Omega)(1-f)]$ then no entry will occur

which will give expected returns of

$$-f(X) + (1-X)(1-f) + X(3-f) + (1-X)(1-f) = 2(1-f) + X$$

The explanation of this expression which is an increasing function of X is that, as before, in the first play, the monopolist fights with some probability X and hence has expected returns from stage 1 of $-f(X) + (1-X)(1-f)$. Now, however, this strategy does deter entry in stage 2, in those cases where the random strategy dictates fighting at stage 1. Thus, second period expected profits are $X(3-f) + (1-X)(1-f)$

Below we graph the expected returns earned by the monopolist from fighting as a function of X. We can see that over some range this function is increasing, while over another range it is decreasing. The optimal X occurs at the point of discontinuity.



Thus the optimal strategy for the weak monopolist at stage 1 is to randomize his strategy (subjecting his decision, say, to the roll of a die) and then to take the strategy which chance dictates. An intuitive explanation of this difficult result is as follows. If the weak monopolist fights with too low a probability (in the limit 0), the probability is that he accommodates, in which case the second entrant will know he is not a thug and will thus enter the market. If however, the weak monopolist fights with too high a probability (in the limit 1), then the second entrant will simply discount the information he observes in the first market (knowing that the "weak" monopolist is simply trying to bluff him, the second entrant will take his chance and call the weak monopolist's bluff). What the "weak" monopolist must do is to choose the probability with which he fights to balance these two opposite tendencies. If he chooses this probability optimally, he will deter the second entrant from entering the market on those occasions where "chance" in fact dictates that he fights the first entrant.

To see the strategic power of this random strategy equilibrium, consider finally the decision of the first entrant of whether or not he should enter local market 1. Clearly this entrant is concerned about the probability of fighting should he enter the market. From the axioms of probability we know:

$$P(F) = P(F/S)P(S) + P(F/W)P(W)$$

$$= \Omega + [\Omega\ f(1-\Omega)] \ / \ [(1-\Omega)(1-f)] = \Omega \ / \ 1-f$$

The first entrant will use this probability in calculating his expected profits from entry, and hence will <u>not</u> enter the market if $\Omega > (1-f)^2$. Since $0<f<1$, we can see from this expression that even a small degree of uncertainty may well dissuade the first, and hence the second entrant from taking on the chain store.

This result is an important extension of the argument in this Chapter to date. To summarize, we saw in Section 9.3 that in a world of complete certainty, strategic threats were only credible if the threat was the optimal ex-post response to the situation, where the agent being threatened calls the bluff of the agent making the threat. Now we have a more general result. In repeated play situations with imperfect information, it is the <u>appearance</u> rather than the <u>reality</u> of ex-post optimal prediction which is important. Now we have a convincing account of why firms make it an important aspect of their competitive strategy to keep information secret, and at times to deliberately misinform market rivals. By so doing, they may well be increasing their ability subsequently to make threats which, in the absence of full information, seem more convincing than they would do if market rivals had access to this information.

9.7 BRAND PROLIFERATION AND DIVERSIFICATION AS STRATEGIC MARKET WEAPONS

In practice, we observe a variety of products of the same general "type" being sold in markets. One can, for example, buy different sorts of shoes, electric kettles, golf clubs and so on. Part of this product diversity no doubt relates to the saturation of the differing needs of consumers in a market economy. In this section, however we examine how firms may use product differentiation as a strategic weapon against other firms. Before attempting, it is useful to distinguish two types of product differentiation - horizontal and vertical. The difference is as follows: If two horizontally differentiated products were offered at the same price, some customers would prefer one of the brands, others would prefer the other brand. If two vertically differentiated products were offered at the same price, one of the two products would be preferred by all. In other words, vertical product differentiation relates to quality differences between goods, whereas horizontal product differentiation relates to different preferences between individuals for different brands when overall quality is the same. Below, we illustrate how horizontal product differentiation might be used by firms as a strategic weapon designed to gain competitive advantage, although the example can easily be generalized to the vertical product differentiation case as well.

Let us then take the case of horizontal product differentiation. The basic idea here is that, by proliferating brands, a firm may be able to fill up the product space in such a way that there are no remaining slots for profitable entry. To examine this issue, we need a suitable conceptual framework. The usual framework in which these issues are examined is due to Hotelling (1929). He imagined a Main Street, with consumers uniformly distributed along it, and with firms producing a physically identical product but situating themselves at different points along the street. It may be easy to think of Hotelling's main street as a beach with various ice cream sellers situated at different points along it. The crucial point to notice in this context is that because of transportation costs, the apparently identical good will in fact be differentiated in the eyes of the various consumers - consumers will prefer the good that is located nearest to them. Further, if there are several active sellers, and if consumers take account not just of market prices but also of the distance they have to travel to purchase the good, then a small change in the price of one of the "brands" will only affect the demand for those brands in the immediate vicinity of the brand whose price has just been changed. This is the phenomenon of location competition in differentiated product markets.

With this background, we can now examine the issue of the strategic use of brand proliferation by firms, using the model of Schmalensee (1978), which itself is a simple extension of the Hotelling framework. Schmalensee (1978) makes several key assumptions in his analysis. First, he assumes that for individual brands, at least at low levels of output, the unit cost of production falls with increases in output. Without such a range of increasing returns, each consumer in the country would be able to purchase at reasonable cost a brand of the good in question tailored exactly to his tastes. Secondly, he makes a Hotelling type assumption that small changes in a brand's price are felt only by its two closest neighbours on the line. However, in slight contrast to Hotelling, Schmalensee (1978) imagines his buyers to be uniformly distributed around a circle of unit circumference (as we shall see, this simplifies the mathematics of the problem). Finally, Schmalensee assumes that changes in location are not costless in the sense that it is not generally costless to change brands' locations in the space of consumer perceptions of attributes provided. The existence of such repositioning costs is well documented in the marketing literature.

With these three assumptions of increasing returns, localized competition, and relative immobility, consider a solution where there are N established brands located distances 1/N apart around a circle, all commanding, the same price p. For simplicity, suppose all potential entrants face expected kinked demand curves at this price - that is they feel that established rivals would not match prices above p. On the other hand, they expect prices below p to be rendered unattractive by drastic retaliatory price cuts by established brands. Any new entrant would thus charge p.

As in the Hotelling model, with each brand selling at the same price, buyers patronize the "closest" brand. Under the above assumptions, each brand is closest for buyers located at all distances from it less than or equal to 1/2N, i.e. half the distance to its rivals on either side. With these assumptions we can write the demand curve for each brand as :

$$q = q(P,N)$$

That is, the demand for each brand will be a function of the brands price (local competition effect) and the overall number of brands (market size effect). As an individual seller lowers the price of his good, the demand for it will increase as customers are attracted away from neighbouring sellers. On the other hand, as the total number of sellers increase, the demand for an existing seller's good will decrease as some marginal customers (the ones located furthest from the existing seller) are attracted to the easier location of the new entrant. Profits of a typical brand can be simply written as:

$$\pi = pq(P,N) - c$$

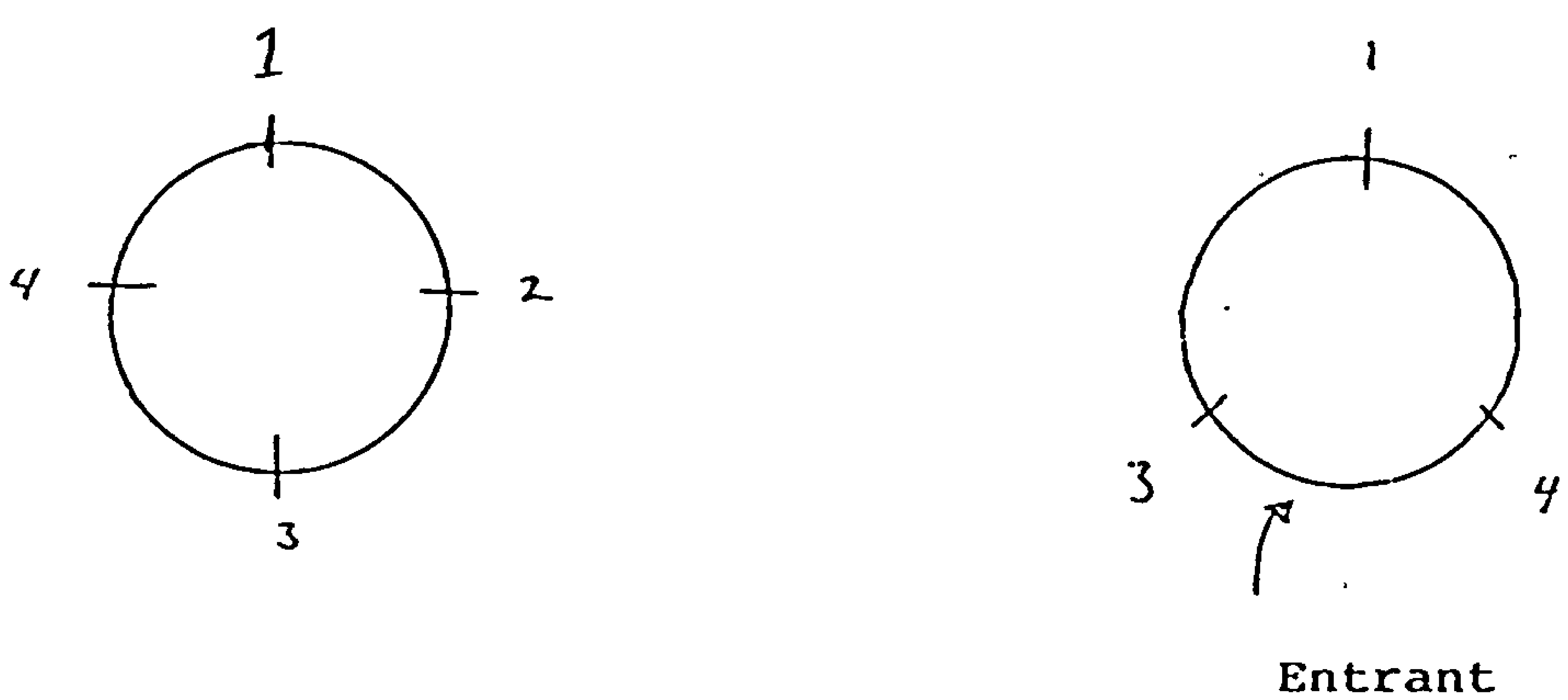
Fix p and let $\tilde{N}$ be the solution of $\pi(p\tilde{N})=0$, i.e. if the number of sellers in the market increases sufficiently, there will eventually be a market saturation effect and the profitability of each seller will be driven to zero. This saturation level of sellers is $\tilde{N}$. Established brands are thus profitable so long as $N < \tilde{N}$.

An entrant must locate somewhere between two established brands and will in fact do best by locating exactly in the middle of any open interval between two existing sets of brands. Such an entrant's sales will be made only a distance 1/4N to the left, and 1/4N to the right - halfway to the nearest rival brands. If the rivals are immobile, sales at that level must rationally be expected to persist. The new brand's profit will then be $\pi(p,2N)$. It follows that the entrants profits will be positive only if $N < \tilde{N}/2$. Hence, as long as $\tilde{N}/2 < N < \tilde{N}$, all existing brands earn positive profits, but any entrant would suffer losses.

To illustrate a simple case, see Figure 9.9 below. In the first circle we illustrate a market as above with $\tilde{N}=4$, and the four brands situated symmetrically around the circle. Each brand attracts one quarter of the customer base which just ensures zero profitability. Consider a monopolist that produces three brands in this market, positioned symmetrically as in the second circle. In this case a new entrant can at most capture one sixth of the customer base and hence will not break even.

FIGURE 9.10

A B



$\bar{N}$ = 4 but now existing brands are positioned differently

The detailed features of this example obviously depend on some strong simplifying assumptions, but the general principles it illustrates do not. What we have in fact examined here is a more complex analysis of the "commitment" analysis in Section 9.3 and 9.4. The crucial feature of the analysis is that brand selection involves irreversible costs which persuade the entrant that one's existing product mix is there to stay. If the entrant thought that, by entering, he could quickly persuade the incumbent to reposition his brands so that the entrant could avoid losses (say he thought that by entering the market in the case of Figure 9.10 B, he could persuade the incumbent to "move" his brands 2 and 3 up to position 2 and 4 in figure 9.10 A, then he would have every incentive to enter the market. With sunk costs in brand selection however, the entrant cannot rely on this and must in fact realize that in the case above, all the incumbent has to do is to "stick his ground" and let losses drive the entrant back out of the market. Thus, given the sunk costs in brand selection, product diversity can be an effective strategy to maintain a competitive advantage.

It is easy to generalize the above discussion to cases where, rather than being concerned about product proliferation, we concentrate instead on diversification by firms. Consider, for example, the simple "horizontal" diversification strategy of setting up a chain of retail pharmacies diversified across locations. Assume away for the moment any possible economies of such things as bulk purchasing and concentrate on the advantages of optimal location. Again, we can use Hotelling's Main Street to discuss this issue. The closer pharmacies are located together, the fewer customers each will attract and the lower will be their profits. By locating further apart, profits will be increased but if too large a gap is left in the market, this will attract entry and profits will fall again. The trick for the chain is to spread out its shops far enough to make handsome profits yet close enough such that there are no gaps in the market which are profitable enough to attract entry (see Hay (1976) for a detailed model). The argument is exactly analogous to the Schmalensee argument of the previous section.

Once again of particular interest to our concern is the role that sunk costs play in the above argument. This can be brought out by considering why potential entrants in the above example, do not try to enter next door to an existing shop in the expectation that the latter will feel crowded and shift itself further away. As we explained in the previous section, such an expectation might be quite reasonable if "moving stop" was as easy as moving an ice cream van further along the beach. However, with a chemists shop, there will undoubtedly be location specific sunk costs such as the stock of goodwill built up over time from a known customer base overtime. Such sunk costs are not recoverable if the pharmacy has to move location and serve as a credible signal to potential entrants that the incumbent intends to remain in the local market. It is the non-salvagable nature of assets such as customer goodwill that makes the threat not to move so credible.

9.8 VERTICAL INTEGRATION

The strategic advantages and disadvantages of vertical integration has always been a much disputed topic in the field of Industrial Economics. For example, Comanor (1967) has argued that, by raising the capital requirement of entry, vertical integration can be an effective strategic weapon of entry deterrence if the cost of raising finance in the capital market is an increasing function of the sum raised. On the other hand it can be pointed out that if indeed vertical integration does permit higher profits for incumbents in the short run, this will constitute a signal to other firms and the capital market, which will inexorably attract new entry. It is not our intention to review their arguments in any detail, but to focus instead on the light our analysis throws on the vertical integration issue. We would argue that the strategic motives for vertical integration must relate to the exploitation of sunk costs and / or reputation effects by firms - otherwise the strategy is almost bound to lack credibility.

It is possible to envisage many reasons within our framework why vertical integration might constitute an attractive strategic market move. For example, to pick up the theme of section 9.7, integration may be a means to increase the product differentiation barrier. It will be remembered from that section that careful selection of market brands may effectively deter entry. Since integrated firms manufacture their own inputs, they have increased opportunities to vary the specification of inputs which may be necessary to offering desired range of differentiated products in the final goods a market.

More subtly, consider an incumbent with market power in industry A who sells a quantity of his output into a related market B. Lacking the means to commit in industry A, perhaps because the technology does not allow irreversible investment decisions, or lacking the desire to overcommit too heavily in A because if there is entry, the incumbent would rather be a "puppy dog" (to use the terminology of Section 9.5), the incumbent may still be able to signal his commitment to the industry by making an irrevocable commitment in the market B. This may be sufficient either to deter entry or reduce the number of entrants who now realize the incumbent _is_ committed to the industry. A good example of this might be an airline (industry A) which invests heavily in a local market network (industry B) and commits funds to promote his own name. The airline industry may be highly contestable (capital can easily be transferred to other air-routes), while the local marketing network may be non-contestable because of, for example, goodwill and reputation effects. Without commitment of funds to the marketing network by the incumbent, an aggressive entrant would have a much better chance of dislodging the incumbent from the air-carrier market.

9.9 LEGAL AND REGULATORY ISSUES - THE PATENT SYSTEM

In our discussion of strategic market moves so far, we have considered many ways in which firms might act strategically to shut the door on the possibility of competition. As a final important contribution to the discussion, let us remember that transactions and interactions across markets by firms must be set against the background of a complex legal system of entitlement and enforcement designed to ensure that markets do not degenerate into a state of anarchy. It has long been realized by economists that firm's may attempt to strategically manipulate the legal framework upon which they depend for orderly transactions across markets, in order to gain a competitive advantage over market rivals, potential or actual. This is not quite the same thing as manipulating the individuals who police any given regulatory environment - the case of "regulator capture" is well documented and is not our concern here. What is at issue is the arguably more complex problem of a firm manipulating the regulatory framework per se to its own advantage. There have been several examples of this proposed in the literature, but the most famous and contentious issues revolve around the patenting system and the questions of whether patents act as a catalyst or a deterrent to invention.

This issue can best be discussed in reference to a model due to Gilbert and Newbery (1982). They imagine a market currently dominated by one incumbent monopolist and where entry into the industry can only take place through the invention and patenting of a single patentable substitute for the monopolist's product. Assume there is a competitive environment for this single patentable substitute. In reality the mechanics of the patent race between the various competitors for the patent is likely to be extremely complex (see, for example, Harris and Vickers, 1985). To simplify matters, however, Gilbert and Newbery assume that the patent race can be modelled as an auction, with the winner of the race being the agent who submits the highest bid for the patent, and with the losers incurring no irrecoverable costs by submitting losing bids. This is clearly an unsatisfactory modeling assumption, but does have the advantage of clarifying important issues, as will be demonstrated below.

The essence of the Gilbert and Newbery argument can be explained simply.

Let:

π_d = profits per firm under duopolistic production.

π_m = profits occurring to any single firm under monopoly.

α = the extra cost an inefficient incumbent must incur to beat the most efficient potential entrant in the patent race (if there is no such inefficiency $\alpha = 0$)

α_{max}= the excess of industry profits with monopoly over industry profits with duopoly (if there is perfect collusion $\alpha_{max} = 0$. More generally $\alpha_{max} = \pi_m - 2\pi_d > 0$).

There will, of course , be an incentive for the incumbent monopolist to pre-emptively patent the substitute product if the profits from pre-emption exceed the profits from losing the patent race and subsequently earning duopoly profits. What will the monopolist "bid" in the patent race in these circumstances and how will this bid compare with the highest "bid" of the potential rivals for the substitute product? We know that in the competitive scramble amongst the potential entrants, they will bid up to π_d to gain the patent (any bid up to this price will ensure subsequent profitability). Further, we know that in the event of entry the current incumbent will earn π_d, whereas if he pre-empts the bids from his rivals for the substitute product, he must spend α more than π_d and thus will earn post-patent race profits $\pi_m - [\alpha + \pi_d]$. Thus the incumbent has an incentive to pre-emptively patent the substitute product if:

$$\pi_m - [\alpha + \pi_d] > \pi_d$$

i.e. if: $\pi_m - 2\pi_d > \alpha$

In many cases this may well be the case - so long as the monopolist's inefficiency in Research and Development does not exceed the difference between monopoly and total duopoly profits (which might very well happen, especially if the post-patent race game was likely to be non-cooperative), the incumbent has an incentive to pre-empt competition for the substitute product, even if, having won the patent race, the monopolist decides not to produce the substitute product, but instead to let the patent sleep.

This Gilbert and Newbery argument has been subjected to some criticism. Salant (1984), for example, has pointed out that the result is valid only if one assumes the sale of patented technology is impossible. Such a situation can arise if, for instance, the cost of bargaining about the terms of the sale is high. Nevertheless, under the Gilbert and Newbery assumptions, the result is valid, and the argument demonstrates clearly the possibility that the legal system itself (in this case the patent system) may give rise to strategic moves by firms designed to exploit this legal framework to their own advantage.

9.10 CONCLUSION

We by defining exactly what we mean by "strategic". It is a word that is perhaps used too much, but Schelling's

(1960) definition clarifies the concept - a strategic move is a move designed to alter the behaviour of others. We proceeded to apply this notion to the question of actual and potential competition between firms. For a strategic move to be successful, it must influence other firms' expected payoffs from the various courses of action open to them. We examined two ways in which this can happen.

The first is for the strategic move to influence, in a lasting way cost or demand conditions. Investments in capacity, R & D and advertising have been the major strategic weapons to be examined. Strategic use of expenditure on these items is possible because of the nature of the costs associated with them - they are, at least to a degree, "sunk" costs, and hence require an irreversible commitment by the firms that use them. We examined a verity of possible commitments by firms and concluded that the scope for strategic use of these weapons was a function of the nature of market competition (in particular whether it was price sensitive), and the nature of the investments themselves - certain types of investment expenditure (eg. physical capacity) make a firm more aggressive when it comes to price competition, while other investments (eg. advertising) can make a firm less aggressive in the same environment.

The second way for a strategic move to succeed is for it to influence the beliefs of those whose behaviour it is designed to affect, even if it does not affect actual cost and demand conditions at all. With asymmetric information between market participants, the less informed firms will make inferences from the behaviour of more informed rivals. We examined this theme with reference to the vexed question of predatory pricing and concluded that, because in a world of uncertainty, appearance rather than reality is what counts, firms may well engage in predatory practices to gain a reputation for toughness which is designed to influence the beliefs of other firms in the market, and those that might be contemplating entry.

We broadened the discussion introducing the complexities of multi-product firms operating in multi-product markets and those arising from the existence of the legal and regulatory framework. In this environment, the possibilities for strategic moves designed to influence a firm's competitive position are even more manifold.

PART V - EMPIRICAL TESTS

CHAPTER 10

TESTS FOR THE EXISTENCE OF COMPETITIVE ADVANTAGE

10.1 THE STATE OF KNOWLEDGE

In earlier parts of this thesis we have examined the analytical and empirical literature concerning internal and external aspects of competitive advantage.

As far as the internal aspects are concerned, the main focus has been on the pay / performance relationship, the conjecture being that a company might gain a competitive advantage over its market rivals by employing some approximation to optimal managerial contracts. The conjecture has been tested almost exclusively on cross - section data. Given that inter-firm and inter-industry differences are likely to be key variables in explaining differences in compensation levels, the use of executive remuneration data across companies at a particular point in time (rather than considering the extent to which compensation varies over time with performance) casts doubt on the robustness of the results. This problem is compounded further by the general inconclusiveness of the findings. Virtually all the studies are plagued with the issue of causation : does improved corporate performance arise from appropriate managerial incentives for greater effort; or does improved performance arise for other reasons, higher managerial compensation merely reflecting the improvement in performance?

A rather similar conclusion emerges from the empirical literature concerning the external aspects of competitive advantage, particularly the empirical work within the framework of the structure - conduct - performance paradigm. The use of both cross-sectional data and time series pooled data has lead to a host of conflicting arguments with regard to the exact nature of the relationship between seller concentration and profitability. Furthermore, much debate has focused on the fundamental issue as to whether the degree of concentration affecting firm performance is due in part to the market power of the firm to raise prices, or whether any SCP effect is due to one or more firms having greater efficiency and lower costs. The issues become even more complex when long run cost factors are introduced. Are the large firms operating at a lower point on this function and thus leading to industries becoming more concentrated?; or is the problem one of distinguishing between the effects of scale economies and entry barriers and / or other concentration effects? Many of the empirical tests are also ambiguous : for example, the hypothesis of a possible positive relationship between industries in high risk classes, as measured by beta values, and performance has found support; but several studies have found no relationship. An issue addressed by some studies is the appropriate unit for analysis. The notion of an industry as a unit for analysis becomes problematic when firms are highly diversified, or goods differentiated. Therefore, the analysis at the industry level could not only be uninteresting, but misleading.

The foregoing considerations suggest that it might be illuminating to investigate new methods of testing for possible internal and external routes to competitive advantage. Cross - section methods have not been conspicuously successful in throwing light on the issues involved, so it is useful to consider what can be achieved by time series methods. In what follows we will examine what cointegration methods of time series analysis have to offer.

10.2 COINTEGRATION

The Cointegration approach to time series analysis interprets equilibrium relationships as being statistical properties of time series for which tests can, and should, be conducted. The approach has its roots in two bodies of literature : the statistical literature on testing for unit roots and stationarity in time series, and the econometrics literature on distinguishing actual from spurious relationships between variables. The concept of cointegration was coined in the 1980's, the seminal paper usually being taken to be Granger (1983, eventually published in 1986). As far as we are aware, the approach has not been applied to the topic of competitive advantage. The empirical work reported later in this section can be seen as a modest, preliminary attempt to discover whether the notion of cointegration can shed light on the possibilities for gaining competitive advantage by way of the routes discussed in Parts II and III of this thesis. In particular, we will use the cointegration approach to ask two questions : is there a tendency for an individual firm's share price to converge onto an equilibrium relationship with share prices in the market or economy as a whole? ; and is there a similar tendency to converge onto an equilibrium relationship between executive pay and the parent firm's share price? At the outset it must be stressed that the motivation for the empirical work was more one of exploring the possibilities of applying cointegration to the issue of competitive advantage than one of expecting cointegration tests to provide a clear means of arbitrating between the theories under consideration : as might be expected, the results of the cointegration tests are open to more than one interpretation.

On a more positive note, the cointegration approach at least offers a time series perspective on the problem of competitive advantage, as opposed to the cross-section perspective which predominates in empirical work in this area. Given the inconclusive nature of much of the existing empirical work on competitive advantage, it would seem to be worthwhile to see if an alternative framework for empirical tests might be any more successful.

The general problem which the cointegration approach addresses is that of distinguishing spurious from non-spurious systematic co-movements of time series variables in economics (for a discussion which sets cointegration in the context of the spurious correlation problem, see Hendry, 1986). It is not difficult to find correlations between the time series representations of the variables with which economics deals. The conventional approach to ruling out spurious relationships involves little more than requiring that there must be some theoretical reason for expecting a relationship to exist : thus, for example, a correlation between the competitive performance of a firm and the cumulative incidence of dysentery in Scotland would be regarded as spurious given that there is no theoretical story as to why the two phenomena should be linked. The cointegration approach imposes more stringent requirements for relationships to be deemed non-spurious : the variables involved need to be integrated of the same order, i.e. the same degree of differencing is required to induce stationarity and the implied tendency to return to a mean value. In addition, there has to exist a cointegrating vector of coefficients linking the variables such that the system tends to converge onto the equilibrium postulated (see Granger, 1986).

The point of departure is that time series for the variables which, in this context, might affect competitive advantage are non-stationary and require differencing to induce stationarity. Consider the following expression:

$$X_t = a + bX_{t-1} + \epsilon_t \qquad [11.1]$$

The most basic example of non-stationarity is the random walk without drift case, gained by setting a=0 and b=1 in [11.1]. In this case [11.1] can be re - written as:

$$X_t = \Sigma_{i-1}\epsilon_{t-i} \quad \text{given } X_o=0 \qquad [11.2]$$

where ϵ is an independently, normally distributed innovation with zero mean and constant variance. This process is non-stationary, there being no tendency to return to a mean value : the moments of the distribution of X estimated over any given time interval will not tend to converge on the moments of the population distribution - the variance of X, for example, increases as $t\sigma^2_\epsilon$ (see Dickey and Fuller, 1979). The series has an indefinitely long memory, each past innovation having an equal impact on the current realisation of X, as contrasted with the stationary case $0<b<1$ where past innovations decay in importance over time, and the explosive case, $b>1$, where past innovations increase in importance over time. In this random walk case, first differencing will clearly induce stationarity, X having the same properties as ϵ. In order that there be a non-spurious relationship between a set of variables, $X_1, X_2 \ldots . X_n$ it is necessary that the same degree of differencing is required to induce stationarity, otherwise the variables will show no tendency to cohere together over time.

For the variables under consideration to tend to converge on some equilibrium configuration it is necessary, but not sufficient, that they are integrated of the same order : the latter condition does not rule out the case where the relationship between the variables is characterised by a residual which is non-stationary, implying that there is no tendency to converge onto the equilibrium relationship postulated. A further consideration necessary for cointegration, then, is that there exists a cointegration relationship:

$$X_{1,t} = \alpha_1+\alpha_2 X_{2,t}+\alpha_3 X_{3,t}+\ldots\ldots+Z_t \quad [11.3]$$

such that $Z_t \sim I(0)$, i.e. that the Z residual is stationary, where I(0) indicates "integrated of order zero", I(1) indicates "integrated of order one", and so on. The Z residual is usually specified as IN $(0,\sigma^2_z)$, i.e. as an independently, normally distributed innovation with, accordingly, a zero mean and constant variance. If the null hypothesis that $Z_t \sim I(1)$, i.e. that Z_t has a unit root, cannot be rejected, the implication is that the time path of the X variables in relation to the equilibrium postulated is random : the co-movements of the X variables are misleading, there being no tendency for the variables to cohere in a relationship which, for want of a better term, might be thought of as an equilibrium.

In the empirical work reported in Chapter 11 we will be concerned with the bi-variate case of cointegration, the variables in question being pair-wise combinations of share prices for individual firms, share prices in the rest of the market or economy, and executive compensation. Central to the empirical work will be tests for unit roots in these variables. The presence of a unit root implies that a variable can take on any value with non-zero probability. This is clearly implausible for the variables under consideration, share prices, for example, being bounded from below by asset scrap values, and from above by the finite nature of wealth. In an attempt to deal with this problem the analysis will be couched in terms of the (natural) logarithms. This is an imperfect solution because, of course, logarithms themselves are not bounded : lnX, for example, has no superior limit as X approaches ∞. Given that the first derivative of lnX, X^{-1}, does have a bound, approaching zero as X approaches ∞, the use of logarithms comes closer to natural numbers in respecting the boundedness of the time series in question.

The cointegration tests reported in the next chapter deal with two questions : is the share price of an individual company cointegrated with the share price of the sector in which it operates, or with share prices in the economy as a whole?, and is the compensation paid to the senior, or highest paid executive officer of a company cointegrated with the companies share price? As far as the former question is concerned, the presence of cointegration could be seen as prima facie evidence that competitive advantage has not been sustained over the period in question. In relation to the second question, the presence of cointegration could be interpreted to imply that the executive compensation schedule is serving to align the interests of the principal (the shareholders) with those of the agent (the executive). The absence of cointegration could be seen as implying, in relation to the first question, that there are opportunities for sustained competitive advantage and, in relation to the second question, that the executive's compensation, although perhaps nominally tied to performance, as measured by the share price, has no deep-seated relationship with the share price of the company. As far as both questions are concerned, any moron would expect, and could find, a positive correlation between the time series variables under consideration. There would be no way of knowing, however, whether the correlations were spurious, or of some significance. The conditions for cointegration serve to define a more stringent test for distinguishing spurious from non-spurious relationships. The presence of a cointegration relationship between a set of variables does not in itself, of course, say anything about causality : any causal relationship inferred would be in the eye of the beholder, not endemic in the time series data.

Unit Root Tests

Given that we are interested purely in the case of whether two variables, X_1 and X_2, are cointegrated, the tests for cointegration can be simplified. Define a variable Y, such that

$$Y_t = \ln X_{1,t} - \ln X_{2,t} \qquad [11.4]$$

In such circumstances the condition for cointegration becomes simply that the $Y_t \sim I(1)$ null hypothesis can be rejected in favour of the $Y_t \sim I(0)$ alternative : if $Y_t \sim I(1)$, the behaviour of $\ln(X_{1,t}/X_{2,t})$ is random, and there is no tendency to return to equilibrium or any other fixed point; if $Y_t \sim I(0)$, however, ln $(X_{1,t}/X_{2,t})$ is stationary, and will tend to revert to some mean value $\ln(X_{1,t}/X_{2,t})^*$. In relation to the tests to be conducted, our first question defines X_1 as the firm's share price, and X_2 as share prices in the sector or economy as a whole, and the cointegration tests ask whether there is a tendency to converge on an equilibrium ratio between the two prices; and in the second question X_1 is defined as the compensation paid to the senior executive, and X_2 as the firm's share price, and the cointegration test is for the existence of an equilibrium compensation - share price relationship. Using the notion introduced in [11.4], the critical question is whether we can reject the null hypothesis that there is a unit root in Y_t.

General surveys of the problem involved in testing for unit roots in time series can be found in Dickey, Bell and Miller (1986), Phillips (1987) and Engle and Granger (1987). The central problem can be seen in relation to the following equation:

$$Y_t = \beta_0 + \beta Y_{t-1} + \epsilon_t \qquad [11.5]$$

It might be thought that the appropriate way to test for a unit root in Y_t would be to run regression equation [11.4] and see if the null hypothesis $\beta=1$ can be rejected : if not the unit root hypothesis, implying no cointegration between X_1 and X_2, could not be rejected. The problem is that under the $\beta=1$ null hypothesis the moments of the sample distribution of the estimators will not converge on those of the population, so any inferences drawn from such a regression equation would be invalid.

The Sargan - Bhargava Test

The most straightforward test for cointegration is the Sargan - Bhargava (1983) test which uses the Durbin - Watson (DW) test statistic. This involves the primitive regression equation:

$$Y_t = \beta_o + \epsilon_t \qquad [11.6]$$

The null hypothesis $Y_t \sim I(1)$ is equivalent to the $p = 1$ null hypothesis in :

$$\epsilon_t = p\epsilon_{t-1} + \mu_t \qquad [11.7]$$

where $\mu_t \sim IN(0,\sigma^2_\mu)$. Given that $Y_t - Y_{t-1} = \epsilon_t - \epsilon_{t-1}$, the case where $\beta=1$ in [11.4] above : if ϵ_t follows a random walk, so does Y_t. The Durbin - Watson (DW) statistic is automatically calculated by most regression programmes, so this is a readily available test statistic. Sargan and Bhargava (1983) have calculated confidence limits for this test. Using a 5% size of test, and referring to the sample sizes involved in the tests reported in the next chapter, the null hypothesis that Y_t, as defined in [11.4], has a unit root can be rejected only if the DW for ϵ_t in [11.6] is less than 0.259 in the case of 101 observations, or greater than 1.733 in the case of 11 observations (Sargan and Bhargava 1983, Table 1). The main drawback of the Sargan - Bhargava test is that it is only powerful against the alternative hypothesis that Y_t follows a first-order autogressive process (see Engle and Granger, 1987, for an evaluation).

The Dickey - Fuller Test

The most general form of this test extends equation [11.5] to allow for the possible existence of a time trend : the existence of a significant time trend is fairly implausible in the relation to the two $Y_t = \ln(X_{1,t}/X_{2,t})$ ratios considered in this thesis, but cannot be ruled out *a priori*. Adding a time trend, [11.5] becomes :

$$Y_t = \beta_o + \alpha(T-N/2) + \beta Y_{t-1} + \epsilon_t \qquad [11.8]$$

where (T-N/2) is used as the time trend to ensure a zero mean, N being the number of observations. The Dickey - Fuller test (see Fuller, 1976, Dickey and Fuller, 1979 and 1981) involves subtracting Y_{t-1} from both sides of [11.8], yielding :

$$\delta Y_t = \beta_o + \alpha(T-N/2) + (\beta-1)Y_{t-1} + \epsilon_t \qquad [11.9]$$

The null hypothesis $Y_t \sim I(1)$ is equivalent to $\beta=1$ or $\beta-1=0$ in [11.9]. Thus the $Y_t \sim I(1)$ null can be tested by asking whether $(\beta-1)$ is significantly different from zero. Given the null hypothesis, the relevant test is not the conventional t-statistic but the "Dickey-Fuller t-statistic" the distribution of which was calculated in Fuller (1976). For the latter distribution to be applied we need ϵ_t to be $IN(0,\sigma^2_\epsilon)$: otherwise it would be necessary to add lagged values of Y to [11.9] in order to generate "white noise" innovations for ϵ_t - in a formal sense, the critical values of the test statistics depend on the particular data generation process under consideration. In the particular applications considered in this thesis, such complications do not appear to arise, so we can stay with the "unaugmented" version of the Dickey-Fuller tests. Given a 5% size of test, the null that $\beta=1$ or $\beta-1=0$ cannot be rejected if the t - statistic on the $(\beta-1)$ coefficient in (11.9) is greater than -3.43 (i.e. less than 3.43 in terms of absolute size or modulus) in the case of 250 observations (see the third block in Table 8.5.2 of Fuller, 1976). If the time trend is eliminated for not being significant, as is likely, [11.9] becomes :

$$Y_t = \beta_0 + (\beta-1)Y_{t-1} + \epsilon_t \qquad [11.10]$$

In the case, for a 5% size of test, the unit root null hypothesis cannot be rejected if the t-statistic on the $(\beta-1)$ coefficient in [11.10] is greater than -2.88 (i.e. less than 2.88 in terms of absolute size or modulus) for the case of 250 observations, the case relevant to the results reported in the next chapter (see the second block of Table 8.5.2 in Fuller, 1976).

A word of warning is perhaps necessary here in view of the fact that there is, as of yet, no general theory of optimality in tests for unit roots. Despite this, in the view of two of the leading researchers in this field, "....it appears that the critical values ..... can be used as a rough guide in empirical studies at this point ..."(Engle and Granger 1987, p.270). The field of testing for cointegration is developing rapidly at the moment. Amongst developments which might impinge on the approach adopted in this thesis, is the idea that it is preferable to test for cointegration by investigating error-correction mechanisms, and drawing inferences about equilibrium relationships from the disequilibrium, or error-correction framework (this point was made orally to the author by David Hendry, but has not yet appeared in print). Engle and Granger (1987) suggest that the two approaches can generate equivalent results, so it is perhaps sensible to remain agnostic on this issue. Another approach, not employed in this thesis, is that of Phillips (1987), who develops a framework for testing for unit roots in the presence of "weakly dependent and heterogeneously distributed innovations" (Phillips 1987, p.277). Given that the point of our exercise is to investigate the usefulness of cointegration tests in an area, competitive advantage, to which they have not been applied, perhaps the high priests of econometrics would let us off with a warning!

The main specific caveat to be made regarding our tests for unit roots would apply to any of the methods which could be used : the power of a test of a null hypothesis that $\beta=1$ is not likely to be high against alternative hypotheses which lie near the unit circle, $\beta=0.95$ for example. In a sense, this problem does not matter too much because, for example, $\beta=0.95$ case, although stationary, will imply that the time series in question will display only a weak tendency to return to a fixed value, such as the mean of the series. If the problem of low power of tests is deemed to be important all that we can say is that it is a problem about which not much can be done.

10.3 THE DATA

[a]. THE SAMPLE

An initial sample of 100 companies was chosen, representing the top U.K. companies in terms of market capitalisation during 1987 (Source : Datastream). The observation period ran monthly from January 1970 to October

1987 and it was discovered that, for various reasons, such as merger or acquisition, only 52 companies of the original 100 survived in the top 100 until the end of the period. Therefore the final sample of 52 reflects those companies operating during this seventeen year interval, and are categorised within the following industrial sectors : ten industrial companies; five building materials or supplies and construction firms; five electrical engineering or electronic and computer companies; nine natural resource or petroleum processing firms; two consumer goods and other manufacturing companies; four leisure and service firms; five retail and distribution companies; eleven food and drink or tobacco firms; six holding companies and five U.K. banks or insurance companies.

See Table 11.1 for a comprehensive listing of the sample firms.

1 Allied-Lyons	Sir	Derrick	Holden Brown		156 St. John Street	London		EC1P 1AR
2 Associated British Foods	Mr.	Garry H.	Weston	Bowater House	68 Knightsbridge	London		SW1X 7LR
3 BAT Industries	Mr.	Patrick	Sheehey	Windsor House	50 Victoria Street	London		SW1H 0NL
4 The BOC Group	Mr.	Richard	Giordano		Chertsey Road	Windlesham	Surrey	GU20 6HJ
5 BTR	Sir	Owen	Green	Silertown House	Vincent Square	London		SW1P 2PL
6 Barclays	Mr.	John	Quinton		54 Lombard Street	London		EC3P 3AH
7 Bass	Mr.	Ian	Prosser		30 Portland Place	London		W1N 3DF
8 Beecham Group	Mr.	Robert	Bauman	Beecham House		Brentford	Middlesex	TW8 9BD
9 Blue Circle Industries	Sir	John	Milne	Portland House	Stag Place	London		SW1E 5BJ
10 Boots Company	Mr.	Robert	Gunn		1 Thane Road	Nottingham		NG2 3AA
11 British Petroleum Company	Sir	Peter	Walters	Britannic House	Moor Lane	London		EC2Y 9BU
12 Bunzl	Mr.	James	White	Stoke House	Stoke Green,Stoke Poges	Slough		SL2 4JN
13 Burton Group	Sir	Ralph	Halpern		214 Oxford Street	London		W1N 9DF
14 Cadbury Schweppes	Sir	Adrian	Cadbury		1-4 Connaught Place	London		W2 2EX
15 Courtaulds	Sir	Christopher	Hogg		18 Hanover Square	London		W1A 2BB
16 Dixons Group	Mr.	Stanley	Kalms		29 Farm Street	London		W1X 7RD
17 English China Clay	Sir	Alan	Dalton	John Keay House		St. Austell	Cornwall	PL25 4DJ
18 Fison	Mr.	John	Kerridge	Fison House	Princes Street	Ipswich	Suffolk	IP2 1QH
19 Glaxo Holding	Sir	Paul	Girolami	Charles House	6-12 Clarges Street	London		W1Y 8DH
20 Granada Group	Mr.	Alex	Bernstein		30 Golden Square	London		W1R 4AH
21 Grand Metropolitan	Mr.	A.J.G.	Sheppard		11-12 Hanover Square	London		W1A 1DP
22 Hanson	Lord		Hanson		1Grosvenor Place	London		SW1X 7JH
23 Hawker Siddeley	Sir	Peter	Baxendell		18 St. James Square	London		SW1Y 4LS
24 Imperial Chemical Industries	Mr.	Denys	Henderson	I.C. House	Millbank	London		SW1P 3JF
25 Ladbroke Group	Mr.	Cyril	Stein		87 Wimpole	London		W1M 7DB
26 Lloyds Bank	Sir	Jeremy	Morse		71 Lombard Street	London		EC3P 3BS
27 Marks and Spencer	Lord		Rayner	Michael House	36-37 Baker Street	London		W1A 1DN
28 Midland Bank	Sir	Kit	McMahon		Poultry	London		EC2P 2BP
29 Nation Westminster	Mr.	T.P.	Frost		41 Lothbury	London		EC2P 2BP
30 Pearson	Viscount		Blakenham	Millbank Tower	Millbank	London		SW1P 4QZ
31 Pilkington	Mr.	Antony	Pilkington		Prescot Road	St. Helens		WA10 3TT
32 Plessey Company	Sir	John	Clark		Vicarage Lane	Ilford	Essex	IGI 4AQ
33 Prudential Corporation	Mr.	Brian	Corby		142 Holborn Bars	London		EC1N 2NH
34 Racal Electronics	Sir	Ernest	Harrison		Western Road	Bracknell	Berkshire	RG12 1RG
35 Rank Organisation	Sir	Patrick	Meaney		6 Connaught Place	London		W2 2EZ
36 Rank Hovis McDougall	Sir	Peter	Reynolds	R.H.M. Centre	Alma	Windsor	Berkshire	SL2 3ST
37 Rickitt and Colman	Sir	Michael	Colman		One Burlington	London		W4 2RW
38 Redland	Sir	Colin	Corness	Redland House		Reigate	Surrey	RH2 0SJ
39 Reed International	Sir	Stanly	Grinstead	Reed House	6 Chesterfield	London		W1A 1EJ
40 Rothmans International	Sir	Robert	Crichton-Brown		15 Hill Street	London		W1X 7FB
41 Rowntree	Mr.	Kenneth	Dixon		P.O. Box 202	York		YO1 1XY
42 Royal Bank of Scotland Group	Sir	Michael	Young-Herries		42 St. Andrews Square	Edinburgh		EH2 2YE
43 Sears	Mr.	Geoffrey	Maitland-Smith		40 Duke Street	London		W1A 2HP
44 Shell Trans. & Trading Co.	Mr.	Peter	Holmes		Shell Centre	London		SE1 7NA
45 Tarmac	Sir	Eric	Poutain	Hilton Hall		Essington	Wolverhampton	WV11 2BQ
46 Tesco	Mr.	Ian	MacLaurin	Tesco House	Delamare Road	Cheshunt	HertFordshire	EN8 9SL
47 Thorn EMI	Sir	Graham	Wilkins	Thorn EMI House	4 Tenterden Street	London		W1R 9AH
48 Trafalgar House	Sir	Nigel	Broackers		1 Berkeley	London		W1A 1BY
49 Trusthouse Forte	Hon.	Rocco	Forte		166 High Holborn	London		WC1V 6TT
50 Unilever	Mr.	Mike	Angus	Unilever	P.O. Box 68,Blackfriars	London		EC4P 4BQ
51 United Biscuits Holding	Sir	Hector	Laing	Grant House	P.O.Box 40, Syon Lane	Isleworth	Middlesex	TW7 5NN
52 Whitbread and Company	Mr.	Sam	Whitbread	Brewery	Chiswell Street	London		EC1Y 4SD

[b]. THE DATA SOURCES

The primary source of executive compensation data for the sample companies was, in the first instance, company annual reports, and secondly Monks Publications "Charterhouse Top Management Remuneration for the United Kingdom, 1979 - 1987". The Charterhouse report also contains a comprehensive summary of other firm specific data.

Dividend and monthly share price data covering the period 1970 (1) - 1987 (10) was obtained from Datastream.

[c]. THE VARIABLES

EXECUTIVE COMPENSATION

Under the provisions of the 1967 Companies Act a requirement exists for companies to publish in their Annual Report the emoluments (excluding pension contributions) of the chairman and the highest paid director (when other than the chairman). Executive Compensation is defined as base salary, bonus and the estimated money value of benefits paid in kind. However, these figures do not include the possible impact of any shares or share options which may form a large part of the total compensation package. The holding of such shares or share options is, however, generally reported in each company's Annual Report. In the empirical work, we distinguish between those companies which do and those companies which do not employ share option schemes. It was not possible, however, to distinguish between the different components of compensation (salary, bonus and other fringe benefits).

COMPANY PERFORMANCE MEASURES

In the cointegration tests a specific measure of competitive advantage is adopted in the form of the deviation of a firm's share price from the industry share price or the FT All-Share Index. As discussed previously, there are many measures of performance - return on capital, market share and so on. The rationale for using a firm's share price as the measure of performance rests with the Efficient Market hypothesis. This hypothesis suggests that all relevant information relating to a firm's competitive strategy should be reflected in its share price. The firm's share price therefore encompasses information on all other performance measures. According to the Efficient Markets hypothesis, investors will never knowingly make forecasting errors given current information, thus any discrepancy between the expected rates of return of different assets will quickly arbitrage to eliminate supernormal profits. A survey by Fama (1970) overwhelmingly concluded that data on past returns and asset prices cannot be used to predict changes in actual asset returns - a suggestion that stock markets are perhaps efficient.

Given that corporate performance is measured by a firm's share price, the test for competitive advantage is to ascertain whether there is any systematic deviation between the company share price and that of its competitors. A major issue discussed earlier, however, is the difficulty of delineating properly the market within which firms compete. Initially, tests were conducted using the traditional assumption that firm's compete with others within the same industry. Given that there is some doubt about the concept of a market, however, firms were also judged against the market as a whole, using the FT All-Share Index. It turned out that the results were robust with respect to both measures employed.

CHAPTER 11

TESTS OF THE FIRM - INDUSTRY - ECONOMY - RELATIONSHIP

11.1 INTRODUCTION

Section 10.2 indicated that a test for the existence of competitive advantage is to examine whether the share price of an individual company is cointegrated with the share price of the sector within which it operates, or with share prices in the economy as a whole. The presence of cointegration can be seen as evidence that competitive advantage has not been sustained over the period in question.

A visual inspection of the data (see Appendix 3), does not readily provide an answer. The top 52 U.K. companies display a wide variety of share price experiences and it is not readily apparent whether or not there is any tendency for the share prices to converge on a mean value.

The two conditions necessary for the presence of cointegration were explained in section 11.2. First, the variables must be integrated of the same order.

which implies that the same amount of differencing is required to induce stationarity. In other words :

$$X_{1it}, X_{2it} \sim I(N)$$

where X_{1it} is the share price of the i^{th} firm and X_{2it} is either the share price of the sector in which the i^{th} firm operates or shares in the whole economy (FT All-Share Index). Second, there must exist a cointegration vector for:

$$X_{1it} = \alpha_0 + \alpha_1 X_{2it} + \epsilon_{it}$$

such that $\epsilon_t \sim I(0)$.

11.2 ORDER OF INTEGRATION

To examine the order of integration of the variables, two tests were conducted : the Sargan - Bhargava and Dickey - Fuller tests. The Sargan - Bhargava test involved running regressions for :

$$X_{1it} = \beta_0 + \epsilon_{it}$$

and

$$X_{2it} = \beta_0 + \epsilon_{it}$$

The null hypothesis of a unit root, that $X_{1it}, X_{2it} \sim I(1)$, is rejected in favour of the alternative that X_{1it}, X_{2it} were stationary [I(0)] if the Durbin - Watson test was greater than 0.259 in the case of 101 observations. In levels it was found that the null hypothesis of a unit root could not be rejected (see table 11.1) in any of the 52 firm's share prices, the 13 industries or the FT All-Share price.

The problem with the Sargan - Bhargava test mentioned earlier, however, is that it is only powerful against the alternative that the variables follow a first - order autoregressive process. The order of integration was therefore also tested using the Dickey - Fuller test. The most general form of this test involved running regressions for :

$$\delta X_{1it} = \beta_{i0} + \beta_{i1} (T-n/2) + \beta_{i2} X_{1it-1} + \epsilon_{it}$$

and

$$\delta X_{2it} = \beta_{i0} + \beta_{i1} (T-n/2) + \beta_{i2} X_{2it-1} + \epsilon_{it}$$

If the hypothesis that β_0, β_1 # 0 cannot be rejected, then the hypothesis that $\beta_2 = 0$, that is X_{1it}, X_{2it} ~ I(1) cannot be rejected if the Dickey - Fuller test statistic on β_2 is greater than -3.43 for 250 observations.

The first step, however, was to test the significance of the β_0 and β_1 coefficients using the standard t-test. With a 5% test size, the hypothesis that β_0, β_1 are significantly different from zero can be rejected if the t - statistic is less than 1.98 for 120 observations. In a number of cases the time trend and constant were significant (see table 11.1), but in all cases the null hypothesis that $\beta = 0$ could not be rejected. The tests were re-run excluding first the time trend and then both the time trend and constant. In the first instance, the test was :

$$\delta X_{11t} = \beta_{10} + \beta_{12} X_{11t-1} + \epsilon_{1t}$$

and

$$\delta X_{21t} = \beta_{10} + \beta_{12} X_{21t-1} + \epsilon_{1t}$$

If β_0 proved significantly different from zero, we could not reject the null that $\beta_2 = 0$, for a 5% test size, if the Dickey - Fuller statistic was greater than -2.88 (see Table 11.2). In the second instance, the test was :

$$\delta X_{11t} = \beta_{12} X_{11t-1} + \epsilon_{1t}$$

and

$$\delta X_{11t} = \beta_{12} X_{11t-1} + \epsilon_{1t}$$

The null that $\beta_2 = 0$ could not be rejected if the Dickey - Fuller test statistic was greater than -1.95 for 250 observations (see Table 11.3). It turned out that in no case could the null hypothesis, that there existed a unit root be rejected, the implication being that neither the firm's share prices, industry prices nor the FT-All Share Index were integrated of order zero.

It is important to note here that in all the Dickey - Fuller tests conducted, problems of heteroscedasticity, as reflected in the F(4) statistic, or higher order autocorrelation reflected in the F(12) statistic, did not appear to arise. It did not appear necessary therefore, to add lagged values of X_{1it} or X_{2it}. The unaugmented Dickey - Fuller tests proved sufficient.

Both the Sargan - Bhargava test and Dickey - Fuller tests suggested that we could not reject the hypothesis that variables were I(1) against the alternative that they were I(0).

The Sargan - Bhargava tests were therefore run using the first difference of the variables :

$$\delta X_{1it} = \beta_0 + \epsilon_{it}$$

and

$$\delta X_{2it} = \beta_0 + \epsilon_{it}$$

In this case the null hypothesis was that δX_{1it}, $\delta X_{2it} \sim I(2)$, against the alternative that the variables were integrated of order one. Table 11.4 demonstrates that the variables appear to be integrated of order one. The null hypothesis could be rejected in favour of the alternative. According to the Sargan - Bhargava test therefore, the first condition for cointegration, that the variables are integrated of the same order, appears to be satisfied.

Confirmation of the above results can be gained by re-running the Dickey - Fuller tests in second differences, such that :

$$\delta^2 X_{1it} = \beta_{i0} + \beta_{i1}(T-N/2) + \beta_{i2} X_{1it-1} + \epsilon_{it}$$

and

$$\delta^2 X_{2it} = \beta_{i0} + \beta_{i1}(T-N/2) + \beta_{i2} X_{2it-1} + \epsilon_{it}$$

11.3 COINTEGRATION VECTOR

The second condition for cointegration, that there exists a cointegration vector for :

$$X_{1it} = \alpha_0 + \alpha_1 X_{2it} + \epsilon_{it}$$

such that $\epsilon_{it} \sim I(0)$ is examined in much the same way as above, replacing Y_{it} for X_{1it} and X_{2it} in the above equations, where :

$$Y_{it} = X_{1it} - X_{2it}$$

ie. the log of the company share price divided by the sector or economy wide index.

The Durbin - Watson statistics for the Sargan - Bhargava tests were thus derived from the regression :

$$Y_{it} = \beta_0 + \epsilon_{it}$$

while the Dickey - Fuller test statistics were derived from one of the following regressions :

$$\delta^2 Y_{1it} = \beta_{10} + \beta_{11}(T-N/2) + \beta_{12} Y_{1it-1} + \epsilon_{it}$$

$$\delta^2 Y_{1it} = \beta_{10} + \beta_{12} Y_{1it-1} + \epsilon_{it}$$

$$\delta^2 Y_{1it} = \beta_{12} Y_{1it-1} + \epsilon_{it}$$

depending on whether the constant and time trends were significant. The null hypothesis in each case, as above, was that the variables were I(1) against the alternative that they were I(0).

According to the Sargan - Bhargava test, in no case could the null be rejected when X_{2it} represented the industry share price (Table 11.5). In every case the Durbin - Watson statistic was less than 0.259. The same was true when X_{2it} represented share prices in the whole economy (Table 11.6) with only four exceptions. The share prices of Bunzl, The Granada Group, Grand Metropolitan and Whitbread appeared to converge on that of the FT All-Share price.

The more general Dickey - Fuller tests, however, threw up more diverse results. The first point of interest was that in both cases when X_{2it} represented the industry and economy share prices, the time trend did prove significant in some cases (see Tables 11.5 & 11.8). It does seem dangerous, however, given the limited length of the time period under consideration, to extrapolate outside the data period. It was noted earlier that a significant time trend seems fairly implausible given that a firm's share price is included in the industry price index. A significant time trend would appear to imply that the firm's share price diverges exponentially away from the industry index. Little confidence has therefore been placed in these results and the time trend excluded in all cases.

It turned out that when X_{21t} represented the industry share price and it was appropriate to include a constant (see Table 11.6), the null that there exists a unit root could not be rejected in 11 out of 21 cases (the Dickey - Fuller statistic was greater than -2.89 in all these cases). Where it was appropriate to exclude the constant (Table 11.7), the null could not be rejected in 26 out of 28 cases (the Dickey - Fuller statistic was greater than -1.96 in these cases).

When X_{21t} represented share prices in the economy as a whole and it was appropriate to include a constant (Table 11.9), the null could not be rejected in 10 out of 19 cases and where the constant was excluded (Table 11.10) the null could not be rejected in 26 out of 31 cases.

A caveat to the results must be noted, however. The regressions did appear to suffer in a number of instances from problems of both heteroscedasticity and autocorrelation. These instances are denoted by an asterisk against the LM and Heteroscedasticity test statistics in the results. However, the problems do appear to emerge in those instances where the null hypothesis can be rejected, a situation which perhaps does not undermine the conclusions highlighted below.

11.4 INTERPRETATION OF RESULTS

The results above are, of course, open to many interpretations and given problems of autocorrelation and heteroscedasticity are at best tentative. What they appear to suggest, however, is that opportunities exist to exploit the market, which implies that supernormal profits are sustainable over time. The first condition for cointegration, which states that the variables under consideration must be integrated of the same order, appears to be satisfied without exception. In approximately 75% of the cases, however, there does not appear to exist a cointegration vector such that the regression residuals are I(0). The implication is that the firm's share prices are not cointegrated with either those of the industry in which they compete nor (if the industry is not the appropriate unit of analysis) with the share prices in the economy as a whole. What the above tests have demonstrated is that it is appropriate to test for cointegration formally, rather than just eyeball the curves in question (Appendix 1). Of course, the above tests say little about the manner in which companies may achieve competitive advantage, whether it be through internal or external means.

In the following chapter, ability to sustain a competitive advantage through the use of compensation contracts is investigated.

TABLE 11.1

$H_0 : X_{1it}, X_{2it} \sim I(1)$

S-B Test (DW) and D-F Test (β_2) including Constant (β_0) and Trend (β_1)

COMPANY	D. W.	β_0	β_1	β_2	F(12)	F(4)
ALLIED-LYONS	0.02	0.12	0.00	-0.02	1.43	4.67
		2.02	1.65	-1.46		
ASS. BRIT FOODS	0.02	0.23	0.00	-0.05	1.57	8.92
		2.40	2.33	-2.31		
BAT INDUSTRIES	0.01	0.14	0.00	-0.03	0.94	10.70
		1.92	2.15	-1.78		
THE BOC GROUP	0.01	0.19	0.00	-0.04	0.61	7.31
		2.22	2.11	-2.11		
BTR	0.00	0.17	0.00	-0.05	1.42	11.06
		2.48	2.13	-2.18		
BARCLAYS BNK	0.03	0.28	0.00	-0.05	0.91	11.10
		2.41	1.99	-2.33		
BASS	0.02	0.17	0.00	-0.03	0.63	6.78
		1.84	1.89	-1.73		
BEECHAM GROUP	0.01	0.28	0.00	-0.05	0.65	9.23
		2.46	2.23	-2.37		
BLUE CIRCLE IND.	0.03	0.27	0.00	-0.05	0.89	19.84
		2.44	2.12	-2.37		
BOOTS COMPANY	0.03	0.43	0.00	-0.09	1.16	10.74
		3.25	2.80	-3.18		
BRITISH PETROLEUM	0.02	0.33	0.00	-0.07	1.65	16.88
		2.85	2.66	-2.76		
BUNZL	0.01	0.06	0.00	-0.02	0.95	2.85
		1.63	1.66	-1.31		
BURTON GROUP	0.01	0.07	0.00	-0.02	1.83	11.94
		1.73	1.89	-1.43		
CADBURY SCHWEPPES	0.02	0.20	0.00	-0.05	1.68	6.76
		2.24	2.24	-2.16		
COURTAULDS	0.05	0.10	0.00	-0.02	0.91	5.59
		1.30	1.30	-1.23		
DIXONS GROUP	0.01	0.13	0.00	-0.03	2.79	3.12
		2.57	1.49	-2.08		
ENGLISH CHINA CLAY	0.03	0.20	0.00	-0.04	1.17	7.62
		2.17	2.34	-2.11		
FISON	0.01	0.05	0.00	-0.01	1.48	4.14
		1.13	1.46	-0.88		
GLAXO HOLDING	0.01	0.11	0.00	-0.01	0.85	5.06
		1.89	2.19	-1.62		
GRANADA GROUP	0.02	0.14	0.00	-0.03	0.88	8.92
		1.87	1.43	-1.73		
GRAND METROPOLITAN	0.02	0.13	0.00	-0.02	1.09	9.70
		1.75	1.61	-1.62		
HANSON	0.01	0.10	0.00	-0.03	0.77	7.49
		2.17	1.71	-1.74		

$H_0 : X_{1it}, X_{2it} \sim I(1)$

TABLE 11.1 S-B Test (DW) and D-F Test (β_2) including Constant (β_0) and Trend (β_1)

COMPANY	D. W.	β_0	β_1	β_2	F(12)	F(4)
HAWKER SIDDELEY	0.02	0.39	0.00	-0.07	0.89	7.74
		2.77	2.34	-2.69		
ICI	0.02	0.24	0.00	-0.04	0.94	13.82
		2.04	2.05	-1.98		
LADBROKE GROUP	0.01	0.34	0.00	-0.08	1.69	5.18
		3.40	2.73	-3.22		
LLOYDS BNK	0.02	0.18	0.00	-0.04	0.70	9.39
		2.07	1.83	-1.97		
MARKS & SPENCER	0.01	0.17	0.00	-0.04	0.69	6.44
		2.22	2.20	-2.10		
MIDLAND BNK	0.07	0.37	0.00	-0.07	0.97	11.30
		2.74	1.47	-2.71		
NATIONAL WESTMINSTER	0.02	0.21	0.00	-0.04	0.99	12.80
		2.02	1.74	-1.93		
PEARSON	0.02	0.12	0.00	-0.02	1.15	18.96
		1.55	1.92	-1.43		
PILKINGTON	0.04	0.22	0.00	-0.05	1.13	22.41
		2.29	1.90	-2.19		
PLESSEY COMPANY	0.01	0.13	0.00	-0.03	0.87	4.06
		2.08	2.02	-2.01		
PRUDENTIAL CORP.	0.02	0.17	0.00	-0.03	0.46	15.69
		1.97	2.21	-1.88		
RACAL ELECTRONICS	0.01	0.10	0.00	-0.02	0.67	2.76
		1.45	0.69	-1.18		
RANK ORGANISATION	0.05	0.12	0.00	-0.02	0.89	12.53
		1.41	0.95	-1.37		
RANK HOVIS McDOUGALL	0.02	0.10	0.00	-0.02	1.15	4.20
		1.46	1.72	-1.33		
RICKITT & COLMAN	0.02	0.31	0.00	-0.06	0.63	13.45
		2.51	2.39	-2.43		
REDLAND	0.02	0.38	0.00	-0.07	1.57	13.27
		2.96	2.58	-2.87		
REED INTERNATIONAL	0.02	0.08	0.00	-0.02	0.63	5.60
		1.15	1.71	-1.00		
ROTHMANS INTERNATIONAL	0.02	0.25	0.00	-0.06	1.08	10.55
		2.65	3.07	-2.60		
ROWNTREE	0.02	0.19	0.00	-0.04	2.75	20.07
		2.04	1.68	-1.94		
ROYAL BNK OF SCOTLAND	0.03	0.23	0.00	-0.05	1.96	2.32
		2.31	1.96	-2.21		
SEARS	0.02	0.13	0.00	-0.03	0.51	4.57
		2.06	1.78	-1.87		
SHELL TRANS. & TRADING CO	0.01	0.34	0.00	-0.06	0.80	17.31
		2.72	2.77	-2.65		
TARMAC	0.01	0.10	0.00	-0.02	1.03	12.05

TABLE 11.1

$H_0 : X_{11t}, X_{21t} \sim I(1)$

S-B Test (DW) and D-F Test (β_2) including Constant (β_0) and Trend (β_1)

COMPANY	D. W.	β_0	β_1	β_2	F(12)	F(4)
		1.85	1.95	-1.64		
TESCO	0.01	0.06	0.00	-0.02	0.77	6.77
		1.38	1.86	-1.13		
THORN EMI	0.06	0.27	0.00	-0.05	1.07	10.02
		2.21	1.15	-2.19		
TRAFALGAR HOUSE	0.02	0.20	0.00	-0.04	1.69	17.70
		2.22	1.88	-2.11		
TRUSTHOUSE FORTE	0.02	0.14	0.00	-0.03	0.63	12.72
		2.12	2.09	-1.97		
UNILEVER	0.01	0.17	0.00	-0.03	2.00	11.88
		1.78	1.90	-1.66		
UNITED BISCUITS HOLDING	0.02	0.33	0.00	-0.07	1.51	21.12
		2.87	2.60	-2.76		
WHITBREAD & COMPANY	0.02	0.22	0.00	-0.05	0.89	5.70
		2.33	2.18	-2.23		
PACKING IND	0.02	0.16	0.00	-0.03	1.02	9.99
		1.89	2.19	-1.81		
LEISURE IND	0.01	0.17	0.00	-0.03	1.11	16.40
		1.83	1.91	-1.74		
STORES	0.01	0.19	0.00	-0.03	1.12	9.53
		1.93	1.93	-1.83		
TEXTILES	0.03	0.11	0.00	-0.02	0.73	12.37
		1.37	1.66	-1.29		
BANK	0.02	0.23	0.00	-0.04	1.14	12.18
		2.09	1.76	-2.01		
CHEMICAL	0.01	0.27	0.00	-0.05	0.84	14.32
		2.32	2.34	-2.24		
OIL	0.02	0.39	0.00	-0.06	1.21	22.53
		2.65	2.59	-2.58		
BUILDING	0.02	0.20	0.00	-0.03	1.17	18.26
		1.99	1.97	-1.89		
ELECTRICAL	0.01	0.22	0.00	-0.03	0.63	11.31
		1.96	1.76	-1.87		
MINF	0.03	0.39	0.00	-0.07	0.61	12.28
		3.05	3.08	-3.02		
FOOD RETAIL	0.01	0.16	0.00	-0.02	1.57	10.41
		1.85	1.84	-1.69		
FOOD MANUFACTURE	0.01	0.19	0.00	-0.03	2.05	12.20
		1.86	1.92	-1.76		
FT ALL-SHARE INDEX	0.01	0.18	0.00	-0.03	1.21	16.57
		1.91	1.96	-1.82		

$H_0 : X_{11t}, X_{21t} \sim I(1)$

S-B Test (DW) and D-F Test (β_2) including Constant (β_0)

TABLE 11.2

COMPANY	D. W.	β_0	β_2	F(12)	F(2)
ALLIED-LYONS	0.02	0.02	-0.00	1.43	8.89
		0.50	-0.32		
ASS. BRIT FOODS	0.02	0.03	-0.00	1.64	14.30
		0.70	-0.47		
BAT INDUSTRIES	0.01	0.00	0.00	1.00	10.76
		0.11	0.17		
THE BOC GROUP	0.01	0.03	-0.00	1.00	10.76
		0.74	-0.50		
BTR	0.00	0.03	-0.00	1.25	7.21
		1.82	-0.45		
BARCLAYS BNK	0.03	0.08	-0.01	0.78	16.65
		1.36	-1.21		
BASS	0.02	0.02	-0.00	0.62	11.54
		0.40	-0.17		
BEECHAM GROUP	0.01	0.04	-0.01	0.53	10.51
		1.06	-0.81		
BLUE CIRCLE IND.	0.03	0.08	-0.01	0.80	35.53
		1.20	-1.08		
BOOTS COMPANY	0.03	0.09	-0.02	0.95	12.29
		1.69	-1.50		
BRITISH PETROLEUM	0.02	0.04	-7.00	1.52	16.85
		1.01	-0.77		
BUNZL	0.01	0.01	0.00	0.95	4.17
		0.44	0.19		
BURTON GROUP	0.01	0.01	0.00	1.55	22.70
		0.46	0.05		
CADBURY SCHWEPPES	0.02	0.04	-0.01	1.71	12.72
		0.69	-0.55		
COURTAULDS	0.05	0.07	-0.01	0.94	10.14
		0.97	-0.89		
DIXONS GROUP	0.01	0.06	-0.01	1.70	5.53
		2.65	-1.68		
ENGLISH CHINA CLAY	0.03	0.04	-0.01	1.19	13.66
		0.66	-0.56		
FISON	0.01	0.01	0.00	1.45	7.77
		0.21	0.14		
GLAXO HOLDING	0.01	-0.00	0.00	0.85	8.02
		-0.12	0.75		
GRANADA GROUP	0.02	0.05	-0.01	0.64	13.28
		1.24	-0.97		
GRAND METROPOLITAN	0.02	0.03	-0.01	0.99	17.54
		0.77	-0.56		
HANSON	0.01	0.03	-0.00	0.65	9.95

$H_o : X_{1it}, X_{2it} \sim I(1)$

S-B Test (DW) and D-F Test (β_2)
including Constant (β_o)

TABLE 11.2

COMPANY	D. W.	β_o	β_2	F(12)	F(2)
		1.64	-0.35		
HAWKER SIDDELEY	0.02	0.08	-0.01	0.68	10.46
		1.72	-1.49		
ICI	0.02	0.04	-0.01	0.91	20.41
		0.63	-0.52		
LADBROKE GROUP	0.01	0.08	-0.01	1.25	7.90
		2.56	-2.01		
LLOYDS BNK	0.02	0.05	-0.01	0.66	16.72
		0.99	-0.80		
MARKS & SPENCER	0.01	0.02	-0.00	0.73	10.71
		0.58	-0.29		
MIDLAND BNK	0.07	0.25	-0.04	0.71	21.68
		2.33	-2.28		
NATIONAL WESTMINSTER	0.02	0.06	-0.01	0.86	23.68
		1.04	-0.88		
PEARSON	0.02	0.01	0.00	1.14	36.08
		0.14	0.07		
PILKINGTON	0.04	0.08	-0.02	0.82	31.97
		1.27	-1.12		
PLESSEY COMPANY	0.01	0.03	-0.01	0.87	4.50
		0.77	-0.64		
PRUDENTIAL CORP.	0.02	0.01	-0.00	0.46	28.02
		0.24	-0.06		
RACAL ELECTRONICS	0.01	0.05	-0.01	0.71	1.79
		2.20	-1.55		
RANK ORGANISATION	0.05	0.11	-0.02	0.96	22.68
		1.28	-1.24		
RANK HOVIS McDOUGALL	0.02	0.01	-0.00	1.14	4.85
		0.32	-0.12		
RICKITT & COLMAN	0.02	0.04	-0.01	0.65	16.75
		0.81	-0.64		
REDLAND	0.02	0.07	-0.01	1.12	16.23
		1.51	-1.27		
REED INTERNATIONAL	0.02	-0.00	0.00	0.65	10.03
		-0.01	0.23		
ROTHMANS INTERNATIONAL	0.02	0.00	0.00	1.03	21.54
		0.05	0.16		
ROWNTREE	0.02	0.05	-0.01	2.17	33.07
		1.16	-0.97		
ROYAL BNK OF SCOTLAND	0.03	0.07	-0.01	1.90	1.69
		1.21	-1.04		
SEARS	0.02	0.03	-0.01	0.46	7.45
		1.01	-0.61		
SHELL TRANS. & TRADING CO	0.01	0.02	-0.00	0.82	21.26

$H_0 : X_{11t}, X_{21t} \sim I(1)$

S-B Test (DW) and D-F Test (β_2)
including Constant (β_0)

TABLE 11.2

COMPANY	D. W.	β_0	β_2	F(12)	F(2)
		0.41	-0.22		
TARMAC	0.01	0.01	0.00	1.05	22.46
		0.40	0.00		
TESCO	0.01	-0.00	0.00	0.77	12.60
		-0.11	0.55		
THORN EMI	0.06	0.20	-0.03	0.98	19.51
		1.89	-1.86		
TRAFALGAR HOUSE	0.02	0.06	-0.01	1.42	25.47
		1.15	-0.97		
TRUSTHOUSE FORTE	0.02	0.02	-0.01	0.58	21.84
		0.62	-0.29		
UNILEVER	0.01	0.01	0.00	2.01	12.82
		0.13	0.17		
UNITED BISCUITS HOLDING	0.02	0.05	-0.01	0.93	23.43
		1.21	-0.93		
WHITBREAD & COMPANY	0.02	0.03	-0.01	0.98	9.60
		0.82	-0.58		
PACKING IND	0.02	0.01	-0.00	1.05	18.19
		0.18	-0.03		
LEISURE IND	0.01	0.02	-0.00	0.94	27.74
		0.40	-0.23		
STORES	0.01	0.02	-0.00	1.10	15.17
		0.49	-0.26		
TEXTILES	0.03	0.02	-0.00	0.72	24.18
		0.36	-0.25		
BANK	0.02	0.07	-0.01	0.98	20.57
		1.12	-0.98		
CHEMICAL	0.01	0.02	-0.00	0.85	18.34
		0.40	-0.20		
OIL	0.02	0.04	-0.00	1.15	23.80
		0.66	-0.48		
BUILDING	0.02	0.03	-0.00	1.03	29.60
		0.53	-0.32		
ELECTRICAL	0.01	0.04	-0.00	0.60	17.90
		0.90	-0.65		
MINF	0.03	0.05	-0.01	0.71	21.69
		0.75	-0.66		
FOOD RETAIL	0.01	0.01	0.00	1.54	13.75
		0.39	0.06		
FOOD MANUFACTURE	0.01	0.01	-0.00	1.93	18.20
		0.31	-0.09		
FT ALL-SHARE INDEX	0.01	0.02	-0.00	1.02	17.12
		0.35	-0.14		

$H_0 : X_{11t}, X_{21t} \sim I(1)$

S-B Test (DW) and D-F Test (β_2) <u>excluding</u> Constant (β_0) and Trend (β_1)

TABLE 11.3

COMPANY	D. W.	β_2	F(12)	F(2)
ALLIED-LYONS	0.02	0.00 1.42	1.42	9.29
ASS. BRIT FOODS	0.02	0.00 1.41	1.69	14.53
BAT INDUSTRIES	0.01	0.00 1.73	1.00	10.74
THE BOC GROUP	0.01	0.00 1.34	0.52	13.01
BTR	0.00	0.00 2.68	1.24	16.91
BARCLAYS BNK	0.03	0.00 1.32	0.78	16.43
BASS	0.02	0.00 1.74	0.62	11.54
BEECHAM GROUP	0.01	0.00 1.59	0.54	10.99
BLUE CIRCLE IND.	0.03	0.00 0.97	0.80	35.51
BOOTS COMPANY	0.03	0.00 1.32	0.99	13.67
BRITISH PETROLEUM	0.02	0.00 1.50	1.54	16.56
BUNZL	0.01			
BURTON GROUP	0.01	0.00 1.43	1.49	23.21
CADBURY SCHWEPPES	0.02	0.00 1.10	1.75	13.14
COURTAULDS	0.05	0.00 0.71	0.93	10.26
DIXONS GROUP	0.01	0.01 2.03	1.59	9.72
ENGLISH CHINA CLAY	0.03	0.00 0.78	1.23	14.35
FISON	0.01	0.00 1.71	1.38	7.91
GLAXO HOLDING	0.01	0.00 2.55	0.86	7.99
GRANADA GROUP	0.02	0.00 1.28	0.59	13.32
GRAND METROPOLITAN	0.02	0.00 1.20	0.91	17.40
HANSON	0.01	0.01	0.62	10.52

$H_0 : X_{11t}, X_{21t} \sim I(1)$

TABLE 11.3

S-B Test (DW) and D-F Test (β_2) <u>excluding</u> Constant (β_0) and Trend (β_1)

COMPANY	D. W.	β_2	F(12)	F(2)
HAWKER SIDDELEY	0.02	2.59 0.00	0.67	10.88
ICI	0.02	1.34 0.00	0.92	20.12
LADBROKE GROUP	0.01	1.24 0.00	1.29	8.76
LLOYDS BNK	0.02	2.11 0.00	0.67	16.80
MARKS & SPENCER	0.01	1.39 0.00	0.76	10.45
MIDLAND BNK	0.07	1.53 0.01	0.56	20.57
NATIONAL WESTMINSTER	0.02	0.67 0.00	0.83	24.28
PEARSON	0.02	1.37 0.00	1.13	35.87
PILKINGTON	0.04	1.44 0.00	0.76	30.93
PLESSEY COMPANY	0.01	1.16 0.00	0.87	4.93
PRUDENTIAL CORP.	0.02	0.58 0.00	0.47	27.83
RACAL ELECTRONICS	0.01	1.38 0.00	0.61	1.97
RANK ORGANISATION	0.05	1.72 0.00	0.83	24.47
RANK HOVIS McDOUGALL	0.02	0.38 0.00	1.13	5.04
RICKITT & COLMAN	0.02	1.37 0.00	0.68	16.65
REDLAND	0.02	1.41 0.00	1.09	16.22
REED INTERNATIONAL	0.02	1.51 0.00	0.64	10.03
ROTHMANS INTERNATIONAL	0.02	1.49 0.00	1.03	21.56
ROWNTREE	0.02	1.24 0.00	2.05	31.86
ROYAL BNK OF SCOTLAND	0.03	1.23 0.00	1.92	1.94
SEARS	0.02	1.15 0.00	0.46	7.69
SHELL TRANS. & TRADING CO	0.01	1.61 0.00	0.83	20.87

TABLE 11.3

$H_0 : X_{11t}, X_{21t} \sim I(1)$

S-B Test (DW) and D-F Test (β_2) <u>excluding</u> Constant (β_0) and Trend (β_1)

COMPANY	D. W.	β_2	F(12)	F(2)
		1.47		
TARMAC	0.01	0.00	1.04	22.60
		1.58		
TESCO	0.01	0.00	0.76	12.50
		1.89		
THORN EMI	0.06	0.00	0.81	18.63
		0.24		
TRAFALGAR HOUSE	0.02	0.00	1.36	25.33
		1.09		
TRUSTHOUSE FORTE	0.02	0.00	0.57	22.08
		1.44		
UNILEVER	0.01	0.00	2.02	12.80
		2.22		
UNITED BISCUITS HOLDING	0.02	0.00	0.93	23.54
		1.47		
WHITBREAD & COMPANY	0.02	0.00	1.01	10.37
		1.57		
PACKING IND	0.02	0.00	1.05	18.14
		1.34		
LEISURE IND	0.01	0.00	0.88	27.27
		1.53		
STORES	0.01	0.00	1.11	15.34
		1.73		
TEXTILES	0.03	0.00	0.70	23.91
		1.24		
BANK	0.02	0.00	0.95	20.32
		1.41		
CHEMICAL	0.01	0.00	0.86	18.09
		1.77		
OIL	0.02	0.00	1.16	22.97
		1.52		
BUILDING	0.02	0.00	1.04	29.10
		1.67		
ELECTRICAL	0.01	0.00	0.60	17.59
		1.78		
MINF	0.03	0.00	0.75	22.48
		0.84		
FOOD RETAIL	0.01	0.00	1.55	13.79
		2.55		
FOOD MANUFACTURE	0.01	0.00	1.93	18.08
		1.98		
FT ALL-SHARE INDEX	0.01	0.00	1.04	17.45
		1.85		

$H_0 : X_{1it}, X_{2it} \sim I(1)$

TABLE 1?.4 S-B Test (DW)

COMPANY	D. W.
ALLIED-LYONS	2.07
ASS. BRIT FOODS	2.04
BAT INDUSTRIES	1.95
THE BOC GROUP	1.91
BTR	1.75
BARCLAYS BNK	1.90
BASS	2.03
BEECHAM GROUP	1.98
BLUE CIRCLE IND.	1.87
BOOTS COMPANY	1.96
BRITISH PETROLEUM	1.86
BUNZL	1.81
BURTON GROUP	1.60
CADBURY SCHWEPPES	2.20
COURTAULDS	1.96
DIXONS GROUP	1.64
ENGLISH CHINA CLAY	2.13
FISON	1.72
GLAXO HOLDING	1.80
GRANADA GROUP	1.81
GRAND METROPOLITAN	1.87
HANSON	1.89

$H_0 : X_{11t}, X_{21t} \sim I(1)$

TABLE 11.4 S-B Test (DW)

COMPANY	D. W.
HAWKER SIDDELEY	2.04
ICI	1.76
LADBROKE GROUP	1.71
LLOYDS BNK	1.94
MARKS & SPENCER	2.10
MIDLAND BNK	1.90
NATIONAL WESTMINSTER	1.80
PEARSON	1.85
PILKINGTON	2.07
PLESSEY COMPANY	1.99
PRUDENTIAL CORP.	2.00
RACAL ELECTRONICS	1.87
RANK ORGANISATION	1.88
RANK HOVIS McDOUGALL	2.05
RICKITT & COLMAN	1.89
REDLAND	1.89
REED INTERNATIONAL	2.03
ROTHMANS INTERNATIONAL	1.98
ROWNTREE	1.66
ROYAL BNK OF SCOTLAND	1.83
SEARS	2.01
SHELL TRANS. & TRADING	1.95

TABLE 11.4

$H_0 : Y_{it} \sim I(1)$

S-B Test (DW)

COMPANY	D. W.
TARMAC	2.02
TESCO	2.01
THORN EMI	1.69
TRAFALGAR HOUSE	1.88
TRUSTHOUSE FORTE	1.89
UNILEVER	1.70
UNITED BISCUITS HOLDIN	2.12
WHITBREAD & COMPANY	2.22
PACKING IND	1.89
LEISURE IND	1.70
STORES	1.89
TEXTILES	1.79
BANK	1.78
CHEMICAL	1.73
OIL	1.88
BUILDING	1.74
ELECTRICAL	1.76
MINF	1.80
FOOD RETAIL	1.73
FOOD MANUFACTURE	1.71
FT ALL-SHARE INDEX	1.71

$H_0 : Y_{1t} \sim I(1)$

TABLE 11.5

S-B Test (DW) and D-F Test (β_2) including Constant (β_0) and Trend (β_1) where X_{21t} = Industry Price

COMPANY	D.W.	β_0	β_1	β_2	F(12)	F(4)
Allied-Lyons	0.04	-0.04	0.00	-0.03	1.85*	3.10*
t-statistic		-1.77	-0.65	-1.73		
Ass. Brit Foods	0.11	-0.07	0.00	-0.08	1.56	0.78
		-2.81	1.45	2.84		
BAT Industries	0.08	-0.05	0.00	-0.06	1.02	3.16*
		-2.55	1.87	-2.64		
The BOC Group	0.06	-0.04	-0.00	-0.04	0.61	0.67
		-1.88	0.69	1.94		
BTR	0.00	-0.03	0.00	-0.02	0.93	2.22
		-0.71	0.74	-1.00		
Barclays	0.12	-0.02	0.00	-0.07	2.54*	1.75
		-2.50	0.55	-2.63		
Bass	0.09	-0.03	0.00	-0.08	1.22	0.53
		-2.78	2.54	-2.98		
Beecham Group	0.07	-0.03	-0.00	-0.04	1.19	2.79*
		-1.71	-0.04	-1.84		
Blue Circle Ind.	0.05	-0.03	-0.00	-0.05	0.32	0.71
		-2.38	-2.03	-2.23		
Boots Company	0.06	-0.04	0.00	-0.42	1.76	3.42*
		-2.35	-2.40	-2.42		
British Petroleum Co.	0.15	-0.22	0.00	-0.11	0.93	3.58*
		-3.80	1.20	-3.82		
Bunzl	0.03	-0.04	0.00	-0.03	0.65	0.72
		-1.37	1.23	-1.60		
Burton Group	0.02	-0.04	0.00	-0.02	2.83*	8.39*
		-1.51	1.86	-1.67		
Cadbury Schweppes	0.13	-0.10	0.00	-0.09	2.41*	0.80
		-3.21	-1.19	-3.17		
Courtaulds	0.03	-0.02	0.00	-0.03	1.01	8.97*
		-1.80	-1.08	-1.76		
Dixons Group	0.02	-0.12	0.00	-0.06	3.10*	5.24*
		-3.09	2.00	-3.55		
English China Clay						
Fison	0.03	-0.02	0.00	-0.01	1.03	4.88*
		-0.73	0.72	-0.86		
Glaxo Holding	0.01	-0.01	0.00	-0.18	0.95	0.33
		-0.93	2.23	-1.55		
Granada Group	0.04	-0.03	-0.00	-0.02	1.57	3.84*
		-1.36	-0.10	-1.53		
Grand Metropolitan	0.07	-0.04	0.00	-0.04	1.17	1.08
		-2.02	0.59	-2.08		
Hanson	0.01	-0.17	0.00	-0.06	0.98	3.09*
		-2.33	2.15	-2.47		

TABLE 11.5

$H_0 : Y_{1t} \sim I(1)$

S-B Test (DW) and D-F Test (β_2) including Constant (β_0) and Trend (β_1) where X_{21t} = Industry Price

COMPANY	D.W.	β_0	β_1	β_2	F(12)	F(4)
Hawker Siddeley	0.08	-0.06	-0.00	-0.05	1.49	2.435*
		-2.39	-1.59	-2.46		
Imperial Chemical Ind.						
Ladbroke Group	0.02	-0.07	0.00	-0.06	1.61	3.77*
		-3.26	1.35	-3.80		
Lloyds Bank	0.20	-0.14	0.00	-0.14	2.16*	1.59
		-3.78	2.37	-3.82		
Marks and Spencer	0.11	-0.11	0.00	-0.07	0.57	0.33
		-2.86	1.48	-2.86		
Midland Bank	0.09	0.00	0.00	-0.46	1.62	6.76*
		-1.47	-2.42	-2.26		
Nation Westminster	0.15	-0.02	0.00	-0.09	1.94*	0.97
		-2.90	1.85	-0.31		
Pearson	0.15	-0.07	0.00	-0.09	2.37*	4.07*
		-2.86	-0.73	-2.88		
Pilkington	0.04	-0.04	0.00	-0.04	2.69*	2.55*
		-0.20	-1.47	-1.97		
Plessey Company	0.06	-0.10	0.00	-0.04	1.50	3.36*
		-2.61	-0.17	-2.50		
Prudential Corp.						
Racal Electronics	0.02	-0.04	0.00	-0.02	2.04*	0.75
		-1.28	0.20	-1.54		
The Rank Organisation	0.01	-0.01	0.00	-0.01	1.14	3.24*
		-0.89	0.29	-0.45		
Rank Hovis McDougall	0.02	0.04	0.00	-0.01	1.53	2.92
		0.83	1.09	-0.84		
Rickitt and Colman	0.24	-0.03	0.00	-0.12	0.74	1.09
		-3.23	-0.54	-3.66		
Redland	0.10	-0.04	0.00	-0.07	3.30*	4.50*
		-2.77	-0.21	-2.98		
Reed International	0.13	-0.01	0.00	0.02	1.70	0.94
		-0.75	0.62	-1.04		
Rothmans International	0.13	-0.10	0.00	-0.07	1.35	2.67*
		-2.50	1.63	-2.54		
Rowntree	0.05	-0.02	0.00	-0.03	1.67	7.45*
		-1.26	-0.09	-1.48		
Royal Bank of Scotland	0.16	-0.04	0.00	-0.95	1.01	0.78
		-3.13	-0.79	-3.22		
Sears	0.15	-0.24	0.00	-0.11	1.33	2.56*
		-3.48	1.48	3.52		
Shell Trans. & Trading	0.10	-0.06	0.00	-0.09	1.66	2.12
		-3.50	2.77	-3.53		

TABLE 11.5

COMPANY	D.W.	Bo	B1	B2	F(12)	F(4)
Tarmac	0.03	-0.04	0.00	-0.02	1.96*	1.18
		-1.62	1.76	-1.70		
Tesco	0.06	0.05	0.00	-0.02	1.64	1.48
		-1.29	1.57	-1.33		
Thorn EMI	0.01	-0.04	-0.00	-0.06	0.72	2.24
		-2.69	-2.12	-2.35		
Trafalgar House	0.13	0.07	0.00	-0.06	1.47	2.65*
		-2.56	-0.60	-2.61		
Trusthouse Forte	0.06	-0.15	0.00	0.08	1.44	2.45*
		-2.90	2.48	-2.95		
Unilever	0.10	0.04	0.00	-0.06	1.02	2.45*
		-2.20	1.43	-2.32		
United Biscuits Holdin	0.06	-0.05	0.00	-0.05	1.89*	6.84*
		-1.99	0.89	-2.12		
Whitbread and Company	0.15	-0.13	0.00	-0.11	3.36*	4.01*
		-3.37	1.84	-3.40		

$H_0 : Y_{1t} \sim I(1)$

TABLE 11.6 S-B Test (DW) and D-F Test (β_2) including Constant (β_0) where X_{21t} = Industry Price

COMPANY	D.W.	β_0	β_2	F(12)	F(4)
Allied-Lyons	0.04	-0.03	-0.03	1.86*	2.37
t-statistic		-1.82	-1.78		
Ass. Brit Foods	0.11	-0.05	-0.06	1.65	1.33
		-2.40	-2.44		
BAT Industries	0.08	-0.03	-0.04	1.12	2.83
		-1.89	-1.98		
The BOC Group	0.06	-0.03	-0.03	0.58	0.12
		-1.75	-1.81		
BTR	0.00	-0.00	-0.01	0.83	1.10
		-0.01	-1.10		
Barclays	0.12	-0.01	-0.06	2.58*	0.18
		-2.51	-2.66		
Bass	0.09	-0.01	-0.04	1.31	0.63
		-1.50	-1.73		
Beecham Group	0.07	-0.03	-0.04	1.19	4.30*
		-1.90	-2.05		
Blue Circle Ind.	0.05	-0.01	-0.02	0.29	1.12
		-1.37	-1.14		
Boots Company	0.06	-0.03	-0.03	1.43	2.03
		-1.65	-1.70		
British Petroleum Co.	0.15	-0.18	-0.10	0.97	5.94*
		-3.68	-3.71		
Bunzl	0.03	-0.01	-0.01	0.66	0.53
		-0.64	-1.04		
Burton Group	0.02	-0.01	0.01	3.08*	16.91*
		-0.57	-0.73		
Cadbury Schweppes	0.13	-0.09	-0.07	2.51*	0.82
		-3.02	-2.97		
Courtaulds	0.03	-0.01	-0.02	1.04	16.94*
		-1.47	-1.44		
Dixons Group	0.02	-0.05	-0.03	2.58*	9.72*
		-2.53	-3.42		
English China Clay					
Fison	0.03	-0.02	-0.01	1.08	9.78*
		-0.81	-0.95		
Glaxo Holding	0.01	0.01	0.00	0.94	0.84
		1.08	0.33		
Granada Group	0.04	-0.03	-0.03	1.58	6.99*
		-1.65	-1.86		
Grand Metropolitan	0.07	-0.04	-0.04	1.17	1.93
		-1.95	-2.01		
Hanson	0.01	-0.02	-0.01	0.95	6.03*
		-0.93	-1.46		

$H_0 : Y_{1t} \sim I(1)$

TABLE 11.6

S-B Test (DW) and D-F Test (β_2) including Constant (β_0) where X_{21t} = Industry Price

COMPANY	D.W.	β_0	β_2	F(12)	F(4)
Hawker Siddeley	0.08	-0.05 -2.08	-0.04 -2.14	1.49	2.07
Imperial Chemical Ind.					
Ladbroke Group	0.02	-0.05 -3.60	-0.04 -4.60	1.59	7.55*
Lloyds Bank	0.20	-0.09 -2.97	-0.09 -3.00	2.29*	2.12
Marks and Spencer	0.11	-0.08 -2.46	-0.06 -2.45	0.58	0.58
Midland Bank	0.09	-0.00 -1.40	-0.00 -0.28	1.78	8.43*
Nation Westminster	0.15	-0.02 -2.29	-0.07 -2.49	1.98*	0.79
Pearson	0.15	-0.06 -2.90	-0.08 -2.95	2.42*	4.86*
Pilkington	0.04	-0.03 -1.37	-0.02 -1.35	2.63*	4.69*
Plessey Company	0.06	-0.10 -2.78	-0.04 -2.66	1.50	0.48
Prudential Corp.					
Racal Electronics	0.02	-0.04 -1.70	-0.02 -2.13	1.99*	1.09
The Rank Organisation	0.01	-0.01 -1.52	-0.01 -1.18	1.10	5.21*
Rank Hovis McDougall	0.02	0.00 0.07	-0.00 -0.07	1.57	0.29
Rickitt and Colman	0.24	-0.03 -3.21	-0.12 -3.64	0.72	1.29
Redland	0.10	-0.04 -3.14	-0.07 -3.39	3.06*	3.02*
Reed International	0.13	-0.01 7.19	-0.02 -1.12	1.72	0.09
Rothmans International	0.13	-0.08 -2.07	-0.06 -2.14	1.43	2.20
Rowntree	0.05	-0.01 -1.41	-0.03 -1.68	1.61	14.79*
Royal Bank of Scotland	0.16	-0.04 -3.04	-0.09 -3.15	1.03	0.97
Sears	0.15	-0.18 -3.19	-0.08 -3.24	1.39	0.64
Shell Trans. & Trading	0.10	-0.03 -2.28	-0.05 -2.32	1.37	4.20*

TABLE 11.6

COMPANY	D.W.	Bo	B2	F(12)	F(4)
Tarmac	0.03	-0.02	-0.01	2.01*	1.14
		-0.82	-0.91		
Tesco	0.06	-0.05	-0.02	1.67	2.44
		-1.23	-1.27		
Thorn EMI	0.01	-0.01	-0.01	0.75	2.68
		-1.69	-1.03		
Trafalgar House	0.13	-0.07	-0.07	1.54	3.28*
		-2.58	-2.62		
Trusthouse Forte	0.06	-0.05	-0.03	1.38	4.14
		-1.50	-1.59		
Unilever	0.10	-0.03	-0.04	1.03	4.14*
		-1.75	-1.88		
United Biscuits Holdin	0.06	-0.04	-0.03	1.89*	6.85*
		-1.90	-2.08		
Whitbread and Company	0.15	-0.09	-0.08	3.39	1.21
		-2.82	-2.85		

$H_0 : Y_{1t} \sim I(1)$

TABLE 11.7 S-B Test (DW) and D-F Test (β_2) where X_{21t} = Industry Price

COMPANY	D.W.	β_2	F(12)	F(4)
Allied-Lyons	0.04	0.00	1.92*	2.02
t-statistic		0.09		
Ass. Brit Foods	0.11	-0.00	1.82	1.96
		-0.41		
BAT Industries	0.08	-0.00	0.11	3.88*
		-0.59		
The BOC Group	0.06	-0.00	0.42	0.72
		-0.46		
BTR	0.00	-0.01	0.84	1.10
		-2.84		
Barclays	0.12	-0.01	3.99*	0.04
		-0.88		
Bass	0.09	-0.01	1.42	1.21
		-0.96		
Beecham Group	0.07	-0.00	1.15	4.75*
		-0.80		
Blue Circle Ind.	0.05	0.00	0.30	1.38
		0.36		
Boots Company	0.06	-0.00	1.50	2.16
		-0.40		
British Petroleum Co.	0.15	-0.00	0.97	7.65*
		-0.83		
Bunzl	0.03	-0.00	0.65	0.47
		-1.52		
Burton Group	0.02	-0.00	2.96*	17.19*
		-0.62		
Cadbury Schweppes	0.13	0.00	2.92*	1.20
		0.11		
Courtaulds	0.03	-0.00	1.03	17.17*
		-0.26		
Dixons Group	0.02	-0.01	2.32*	13.35*
		-3.27		
English China Clay				
Fison	0.03	-0.00	0.91	10.20*
		-0.67		
Glaxo Holding	0.01	-0.00	1.00	1.06
		-1.14		
Granada Group	0.04	-0.00	1.54	8.64*
		-0.98		
Grand Metropolitan	0.07	-0.00	1.23	3.27
		-0.52		
Hanson	0.01	-0.00	0.93	6.27*
		-2.56		

$H_o : Y_{1t} \sim I(1)$

TABLE 11.7 S-B Test (DW) and D-F Test (β_2) where X_{21t} = Industry Price

COMPANY	D.W.	β_2	F(12)	F(4)
Hawker Siddeley	0.08	-0.00 0.54	1.55	2.31
Imperial Chemical Ind.				
Ladbroke Group	0.02	-0.01 -3.60	1.21	6.97*
Lloyds Bank	0.20	-0.00 -0.55	2.92*	3.32*
Marks and Spencer	0.11	-0.00 -0.06	0.74	1.25
Midland Bank	0.09	-0.00 -0.23	1.48	14.15*
Nation Westminster	0.15	-0.01 -1.06	2.16*	1.70
Pearson	0.15	-0.00 -0.51	4.02*	6.35*
Pilkington	0.04	0.00 -0.12	2.52*	5.37*
Plessey Company	0.06	0.00 0.66	1.52	0.36
Prudential Corp.				
Racal Electronics	0.02	-0.00 -1.93	1.92*	0.71
The Rank Organisation	0.01	-0.00 -0.16	1.06	5.22*
Rank Hovis McDougall	0.02	0.00 -0.04		
Rickitt and Colman	0.24	-0.03 -1.67	0.79	0.92
Redland	0.10	-0.01 -1.34	3.28*	2.49
Reed International	0.13	-0.01 -1.04	1.46	0.14
Rothmans International	0.13	-0.00 -0.62	1.24	3.44*
Rowntree	0.05	-0.01 -0.92	1.32	15.21
Royal Bank of Scotland	0.16	-0.01 -0.86	1.18	1.94
Sears	0.15	-0.00 -0.76	1.76	2.41
Shell Trans. & Trading	0.10	-0.00 -0.36	1.59	6.08*

TABLE 11.7

COMPANY	D.W.	B2	F(12)	F(4)
Tarmac	0.03	-0.00 -0.55	2.02*	1.11
Tesco	0.06	-0.00 -0.49	1.68	2.64
Thorn EMI	0.01	0.00 0.11	0.56	2.58
Trafalgar House	0.13	-0.00 -0.47	1.24	3.876
Trusthouse Forte	0.06	-0.00 -0.81	1.53	4.570*
Unilever	0.10	-0.00 -1.00	1.14	4.84*
United Biscuits Holdin	0.06	-0.00 -0.98	1.97*	7.30*
Whitbread and Company	0.15	-0.00	3.76*	1.18

TABLE 11..8

$H_0 : Y_{1t} \sim I(1)$

S-B Test (DW) and D-F Test (β_2) including Constant (β_0) and Trend (β_1) where X_{21t} = FT All-Share Index

COMPANY	D.W.	β_0	β_1	β_2	F(12)	F(2)
Allied-Lyons	0.06	-0.05	0.00	-0.05	1.36	0.53
t-statistic		-2.09	-1.03	2.11		
Ass. Brit Foods	0.19	-0.13	0.00	-0.12	1.29	0.91
		-3.53	1.60	-3.57		
BAT Industries	0.06	-0.04	0.00	-0.04	0.72	1.25
		-1.96	1.46	-2.06		
The BOC Group		-0.07	-0.00	0.93	0.80	1.10
		2.58	1.62	36.77		
BTR	0.00	-0.02	0.00	-0.02	1.41	8.38*
		-0.55	0.61	-0.83		
Barclays	0.13	-0.04	-0.00	-0.10	1.26	1.56
		-0.35	-2.89	-3.71		
Bass	0.16	-0.03	0.00	0.90	0.91	0.50
		-2.82	1.73	29.00		
Beecham Group	0.05	-0.02	0.00	-0.03	0.78	1.33
		-1.31	0.00	-1.48		
Blue Circle Ind.	?	-0.05	-0.00	0.06	0.31	1.06
		-3.14	-2.01	-3.02		
Boots Company	0.12	0.08	0.00	-0.07	1.49	2.36
		-3.10	-1.61	-3.20		
British Petroleum Co.	0.11	-0.07	0.00	-0.06	0.76	0.63
		-2.46	0.31	-2.54		
Bunzl	2.22	-0.03	0.00	-0.02	0.89	0.81
		-1.21	1.34	-1.36		
Burton Group	0.02	-0.03	0.00	-0.02	2.04*	10.59*
		-0.13	1.80	-1.55		
Cadbury Schweppes	0.17	-0.20	0.00	-0.15	2.11*	0.56
		-4.09	-2.43	-4.08		
Courtaulds	0.02	-0.02	-0.00	-0.02	1.25	3.14*
		-1.27	-0.45	-1.12		
Dixons Group	0.02	-0.11	0.00	-0.06	2.92*	2.58*
		-2.85	1.92	-3.34		
English China Clay						
Fison	0.02	-0.01	0.00	0.01	1.00	3.984*
		-0.67	0.83	-0.83		
Glaxo Holding	0.01	-0.01	0.00	-0.02	1.19	0.01
		-1.06	2.35	-1.76		
Granada Group	2.25	-0.02	0.00	-0.02	1.38	3.58*
		-1.11	-0.19	-1.31		
Grand Metropolitan	2.15	-0.03	0.00	-0.03	1.37	3.23*
		-1.80	0.53	-1.89		
Hanson	0.01	-0.12	0.00	-0.04	1.22	1.59
		-1.94	1.87	-2.13		

TABLE 11.8

$H_0 : Y_{1t} \sim I(1)$

S-B Test (DW) and D-F Test (β_2) including Constant (β_0) and Trend (β_1) where X_{21t} = FT All-Share Index

COMPANY	D.W.	β_0	β_1	β_2	F(12)	F(2)
Hawker Siddeley	0.04	-0.01	-0.00	-0.02	1.19	2.20
		-0.72	-0.87	-1.18		
Imperial Chemical Ind.						
Ladbroke Group	0.02	-0.07	0.00	-0.07	1.56	2.88*
		-3.26	1.69	-3.79		
Lloyds Bank	0.19	-0.16	-0.00	-0.15	1.03	0.41
		-4.16	-2.61	-4.20		
Marks and Spencer	?	-0.19	0.00	-0.12	0.41	0.06
		-3.57	2.61	-3.60		
Midland Bank	0.02	-0.03	-0.00	0.08	1.57	4.23*
		-2.78	-3.64	-3.38		
Nation Westminster	0.16	-0.05	0.00	-0.12	1.25	0.79
		-3.65	-2.53	-3.90		
Pearson	0.09	-0.03	0.00	-0.04	1.99*	0.43
		-1.61	1.07	-1.73		
Pilkington	0.06	-0.06	0.00	-0.04	2.37*	1.02
		-2.15	-1.41	-2.21		
Plessey Company	0.04	-0.04	0.00	-0.03	1.03	1.95
		-1.87	0.77	-1.74		
Prudential Corp.						
Racal Electronics	0.01	0.00	0.00	-0.00	0.96	1.84
		0.21	-1.19	-0.33		
The Rank Organisation	0.02	-0.01	0.00	-0.03	0.91	3.13*
		-1.53	-1.27	-1.69		
Rank Hovis McDougall	0.06	-0.04	0.00	-0.03	0.98	2.01
		-1.53	0.04	-1.55		
Rickitt and Colman	0.12	-0.01	0.00	-0.06	0.44	1.52
		-1.58	0.27	-2.58		
Redland	0.11	-0.07	0.00	-0.10	2.34*	2.95*
		-3.40	1.30	-3.63		
Reed International	0.14	-0.01	0.00	-0.01	1.15	0.29
		-0.63	0.95	-0.71		
Rothmans International	0.16	-0.11	0.00	-0.07	1.54	1.80
		-2.34	1.28	-2.36		
Rowntree	0.06	-0.02	0.00	-0.03	1.76	3.41*
		-1.48	-0.13	-1.70		
Royal Bank of Scotland	0.06	-0.05	0.00	-0.10	1.16	1.24
		-3.41	-2.96	-3.40		
Sears	0.08	-0.19	0.00	-0.09	1.06	0.14
		-3.10	2.08	-3.17		
Shell Trans. & Trading	0.08	0.01	0.00	-0.05	0.64	3.23
		1.14	1.37	-2.47		

TABLE 11.8

COMPANY	D.W.	Bo	B1	B2	F(12)	F(2)
Tarmac	0.03	-0.05	0.00	-0.03	1.96*	1.26
		-1.66	1.81	-1.78		
Tesco	0.05	-0.04	0.00	-0.02	0.99	0.98
		-1.10	1.73	-1.18		
Thorn EMI	0.03	0.01	-0.00	-0.05	0.90	3.75*
		0.89	-2.33	-2.27		
Trafalgar House	0.10	-0.05	0.00	-0.05	1.64	2.65*
		-2.26	0.33	-2.37		
Trusthouse Forte	0.07	-0.12	0.00	-0.07	1.60	5.11*
		-2.69	2.20	-2.75		
Unilever	0.08	-0.03	0.00	-0.03	1.13	0.61
		-1.57	0.61	-1.74		
United Biscuits Holdin	0.06	-0.05	0.00	-0.04	1.35	3.73*
		-2.01	0.67	-2.16		
Whitbread and Company	0.28	0.21	0.00	-0.18	0.98	1.36
		4.49	1.92	-4.54		

$H_0 : Y_{1t} \sim I(1)$

TABLE 11.9

S-B Test (DW) and D-F Test (β_2) including Constant (β_0) where X_{21t} = FT All-Share Index

COMPANY	D.W.	β_0	β_2	F(12)	F(2)
Allied-Lyons	0.06	-0.03	-0.03	1.31	0.04
t-statistic		-1.84	-1.86		
Ass. Brit Foods	0.19	-0.10	-0.09	1.30	1.64
		-3.13	-3.17		
BAT Industries	0.06	-0.03	-0.03	0.76	0.16
		-1.55	-1.65		
The BOC Group		-0.04	0.04	0.77	0.18
		-2.00	2.07		
BTR	0.00	0.00	-0.00	1.37	6.12*
		0.19	-1.07		
Barclays	0.13	-0.02	-0.06	0.90	0.26
		-2.32	-2.52		
Bass	0.16	-0.02	0.92	1.00	0.63
		-2.29	33.22		
Beecham Group	0.05	-0.02	0.03	0.77	0.13
		-1.55	-1.78		
Blue Circle Ind.	?	-0.03	-0.04	0.32	1.76
		-2.48	-2.33		
Boots Company	0.12	-0.07	-0.07	1.17	0.33
		-2.98	-3.08		
British Petroleum Co.	0.11	-0.07	-0.06	0.76	0.63
		-2.49	-2.57		
Bunzl	2.22	-0.01	-0.01	0.90	0.08
		-0.45	-0.65		
Burton Group	0.02	-0.01	-0.01	2.20*	19.91*
		-0.37	-0.59		
Cadbury Schweppes	0.17	-0.12	-0.09	2.26*	0.05
		-3.28	-3.26		
Courtaulds	0.02	-0.01	-0.01	1.23	5.86*
		-1.38	-1.25		
Dixons Group	0.02	-0.05	-0.03	2.24*	4.89*
		-2.25	-3.20		
English China Clay					
Fison	0.02	-0.01	-0.01	1.05	7.979*
		-0.68	-0.84		
Glaxo Holding	0.01	0.01	0.00	1.11	0.09
		1.12	0.29		
Granada Group	2.25	-0.02	-0.02	1.37	6.82*
		-1.32	-1.57		
Grand Metropolitan	2.15	-0.03	-0.03	1.38	3.12*
		-1.73	-1.81		
Hanson	0.01	-0.01	-0.01	1.15	2.33
		-0.51	-1.15		

$H_0 : Y_{1t} \sim I(1)$

TABLE 11.9 S-B Test (DW) and D-F Test (β_2) including Constant (β_0) where X_{21t} = FT All-Share Index

COMPANY	D.W.	β_0	β_2	F(12)	F(2)
Hawker Siddeley	0.04	-0.01 -1.31	-0.03 -2.05	1.06	3.74*
Imperial Chemical Ind.					
Ladbroke Group	0.02	-0.04 -3.21	-0.04 -4.21	1.57	5.40*
Lloyds Bank	0.19	-0.11 -3.23	-0.10 -3.27	1.09	0.20
Marks and Spencer	?	-0.09 -2.42	-0.06 -2.46	0.50	0.10
Midland Bank	0.02	-0.00 -1.05	-0.00 -0.21	1.39	3.82
Nation Westminster	0.16	-0.03 -2.71	-0.08 -2.97	1.24	0.87
Pearson	0.09	-0.03 -1.71	-0.04 -1.83	2.05*	0.37
Pilkington	0.06	-0.04 -1.67	-0.03 -1.74	2.33*	1.08
Plessey Company	0.04	-0.04 -1.71	-0.02 -1.58	1.04	1.47
Prudential Corp.					
Racal Electronics	0.01	-0.01 -0.96	-0.01 -1.96	0.83	1.98
The Rank Organisation	0.02	-0.01 -1.23	-0.01 -1.19	0.83	1.62
Rank Hovis McDougall	0.06	-0.04 -1.72	-0.03 -1.75	0.98	1.04
Rickitt and Colman	0.12	-0.01 -1.56	-0.06 -2.59	0.44	2.41
Redland	0.11	-0.06 -3.30	-0.08 -3.62	2.50*	5.22*
Reed International	0.14	-0.02 -1.03	-0.02 -1.13	1.22	0.37
Rothmans International	0.16	-0.10 -2.19	-0.07 -2.25	1.68	2.00
Rowntree	0.06	-0.02 -1.61	-0.03 -1.86	1.73	5.63*
Royal Bank of Scotland	0.06	-0.02 -1.71	-0.03 -1.67	1.40	1.65
Sears	0.08	-0.10 -2.30	-0.05 -2.40	1.11	0.31
Shell Trans. & Trading	0.08	0.00 0.89	-0.04 -2.08	0.65	5.92*

TABLE 11.9

COMPANY	D.W.	Bo	B2	F(12)	F(2)
Tarmac	0.03	-0.02	-0.01	2.00*	1.58
		-0.70	-0.84		
Tesco	0.05	-0.03	-0.01	1.02	1.06
		-0.69	-0.77		
Thorn EMI	0.03	-0.00	-0.01	0.89	5.15*
		-0.83	-0.54		
Trafalgar House	0.10	-0.05	-0.05	1.53	2.58
		-2.27	-2.39		
Trusthouse Forte	0.07	-0.05	-0.03	1.61	8.91*
		-1.60	-1.68		
Unilever	0.08	-0.03	-0.03	1.12	0.89
		-1.50	-1.67		
United Biscuits Holdin	0.06	-0.04	-0.04	1.33	4.37*
		-2.00	-2.19		
Whitbread and Company	0.28	-0.16	-0.14	1.19	0.10
		-4.04	-4.09		

$H_0 : Y_{1t} \sim I(1)$

TABLE 11.10 S-B Test (DW) and D-F Test (β_2) where X_{21t} = FT All-Share Index

COMPANY	D.W.	β_2	F(12)	F(4)
Allied-Lyons	0.06	0.00	1.33	0.01
t-statistic		0.31		
Ass. Brit Foods	0.19	0.00	1.57	2.07
		-0.53		
BAT Industries	0.06	-0.00	0.64	0.34
		-0.60		
The BOC Group		-0.00	0.75	0.82
		-0.55		
BTR	0.00	-0.01	1.38	6.19*
		-3.05		
Barclays	0.13	-0.01	1.03	0.03
		-0.98		
Bass	0.16	0.98	1.09	0.44
		0.87		
Beecham Group	0.05	-0.01	0.69	0.25
		-0.90		
Blue Circle Ind.	?	0.00	0.27	2.32
		0.13		
Boots Company	0.12	0.00	1.37	0.36
		-0.81		
British Petroleum Co.	0.11	-0.00	0.83	1.27
		-0.69		
Bunzl	2.22	-0.00	0.84	0.07
		-1.05		
Burton Group	0.02	-0.00	2.08*	20.24*
		-0.75		
Cadbury Schweppes	0.17	0.00	2.74*	1.44
		-0.08		
Courtaulds	0.02	-0.00	1.18	6.01*
		-0.16		
Dixons Group	0.02	-0.01	2.14*	7.40*
		-3.35		
English China Clay				
Fison	0.02	-0.00	0.88	8.218*
		-0.71		
Glaxo Holding	0.01	-0.00	1.19	0.19
		-1.06		
Granada Group	2.25	-0.00	1.24	7.86*
		-0.94		
Grand Metropolitan	2.15	-0.00	1.59	7.55*
		-0.55		
Hanson	0.01	-0.00	1.15	2.58
		-2.68		

$H_0 : Y_{1t} \sim I(1)$

TABLE 11.10 S-B Test (DW) and D-F Test (β_2) where X_{21t} = FT All-Share Index

COMPANY	D.W.	β_2	F(12)	F(4)
Hawker Siddeley	0.04	-0.01 -1.64	1.01	3.86*
Imperial Chemical Ind.				
Ladbroke Group	0.02	-0.01 -3.37	1.42	1.39
Lloyds Bank	0.19	-0.00 -0.51	1.66	0.16
Marks and Spencer	?	-0.00 -0.50	0.77	0.54
Midland Bank	0.02	0.00 0.11	1.27	3.88
Nation Westminster	0.16	-0.01 -1.21	1.48	0.66
Pearson	0.09	-0.00 -0.70	2.11*	0.74
Pilkington	0.06	-0.00 -0.48	2.23*	0.77
Plessey Company	0.04	0.00 0.27	0.87	1.15
Prudential Corp.				
Racal Electronics	0.01	-0.01 -2.28	0.82	1.94
The Rank Organisation	0.02	-0.01 -0.99	0.73	1.48
Rank Hovis McDougall	0.06	-0.00 -0.36	1.06	2.01
Rickitt and Colman	0.12	0.04 -2.06	0.36	2.13
Redland	0.11	-0.01 -1.62	2.56*	4.08*
Reed International	0.14	-0.00 -0.54	1.16	0.30
Rothmans International	0.16	-0.00 -0.61	1.25	2.64
Rowntree	0.06	0.01 -0.95	1.45	5.75*
Royal Bank of Scotland	0.06	0.00 -0.22	1.50	1.19
Sears	0.08	-0.00 -1.04	1.25	0.90
Shell Trans. & Trading	0.08	-0.03 -1.88	0.56	5.973

TABLE 11 .10

COMPANY	D.W.	B2	F(12)	F(4)
Tarmac	0.03	-0.00 -0.78	2.00*	1.53
Tesco	0.05	-0.00 -0.70	1.02	1.16
Thorn EMI	0.03	-0.01 -1.13	0.83	5.119
Trafalgar House	0.10	-0.00 -0.76	1.23	2.77
Trusthouse Forte	0.07	-0.00 -0.69	1.72	9.51*
Unilever	0.08	-0.00 -1.05	1.16	0.85
United Biscuits Holdin	0.06	-0.00 -1.07	1.38	3.76*
Whitbread and Company	0.28	-0.00 -0.68	1.86	1.34

TABLE 11.11

NONSTATIONARY TIME SERIES

Empirical cumulative distribution of $\hat{\tau}$ for $\rho = 1$

Sample Size n	Probability of a Smaller Value 0.01	0.025	0.05	0.10	0.90	0.95	0.975	0.99
				$\hat{\tau}$				
25	−2.66	−2.26	−1.95	−1.60	0.92	1.33	1.70	2.16
50	−2.62	−2.25	−1.95	−1.61	0.91	1.31	1.66	2.08
100	−2.60	−2.24	−1.95	−1.61	0.90	1.29	1.64	2.03
250	−2.58	−2.23	−1.95	−1.62	0.89	1.29	1.63	2.01
500	−2.58	−2.23	−1.95	−1.62	0.89	1.28	1.62	2.00
∞	−2.58	−2.23	−1.95	−1.62	0.89	1.28	1.62	2.00
				$\hat{\tau}_\mu$				
25	−3.75	−3.33	−3.00	−2.63	−0.37	0.00	0.34	0.72
50	−3.58	−3.22	−2.93	−2.60	−0.40	−0.03	0.29	0.66
100	−3.51	−3.17	−2.89	−2.58	−0.42	−0.05	0.26	0.63
250	−3.46	−3.14	−2.88	−2.57	−0.42	−0.06	0.24	0.62
500	−3.44	−3.13	−2.87	−2.57	−0.43	−0.07	0.24	0.61
∞	−3.43	−3.12	−2.86	−2.57	−0.44	−0.07	0.23	0.60
				$\hat{\tau}_\tau$				
25	−4.38	−3.95	−3.60	−3.24	−1.14	−0.80	−0.50	−0.15
50	−4.15	−3.80	−3.50	−3.18	−1.19	−0.87	−0.58	−0.24
100	−4.04	−3.73	−3.45	−3.15	−1.22	−0.90	−0.62	−0.28
250	−3.99	−3.69	−3.43	−3.13	−1.23	−0.92	−0.64	−0.31
500	−3.98	−3.68	−3.42	−3.13	−1.24	−0.93	−0.65	−0.32
∞	−3.96	−3.66	−3.41	−3.12	−1.25	−0.94	−0.66	−0.33

This table was constructed by David A. Dickey using the Monte Carlo method. Details are given in Dickey (1975). Standard errors of the estimates vary, but most are less than 0.02.

FROM : W.A. Fuller
Introduction to Statistical Time Serie
John Wiley & Sons
New York 1976

CHAPTER 12

TESTS OF THE REMUNERATION - PERFORMANCE RELATIONSHIP

12.1 INTRODUCTION

Cointegration tests on the remuneration / performance relationship amount to examining whether there exists a tendency for executive compensation to converge on an equilibrium relationship with the parent firm's share price. The existence of such a tendency may be taken as prima facie evidence that compensation contracts do indeed motivate managers to work in the best interests of the company and therefore could be one manner in which a company could sustain a competitive advantage.

The procedure for testing this proposition is analogous to that applied in the previous chapter. Unfortunately, however, lack of data meant that the rigorous tests presented in Chapter 11 could not be repeated for the remuneration / performance relationship. In the U.K., Chief Executive Officer (CEO) salaries have only been published in the last few years which has meant that for most companies there were only nine data points. Satisfactory tests for cointegration regressions require a larger data sample. In particular, it was not possible to conduct the Dickey - Fuller tests. Furthermore, while critical values do exist for 11 observations for the Sargan - Bhargava test, the confidence which can be placed in the results is severely limited. Nevertheless, the motivation for carrying out the Sargan - Bhargava tests was more one of suggesting a method that can be applied in a more rigorous fashion when or should more data become available.

In the analysis, the results have been separated into two groups representing companies which do not and those that do have stock option schemes (see Tables 12.1 & 12.2 respectively). This is to reflect the notion that stock options may be an important motivational force.

12.2 ORDER OF INTEGRATION & COINTEGRATION VECTOR

Following Chapter 11, the first condition for cointegration is to test for the order of integration of the variables. If it were possible to conduct the Dickey -Fuller test, the method would be to derive the Dickey - Fuller test statistics from the regressions :

$$\delta\ C_{it} = \beta_{i0} + \beta_{i1}(T-N/2) + \beta_{i2}C_{it-1} + \epsilon_{it}$$

$$\delta\ X_{1it} = \beta_{i0} + \beta_{i1}(T-N/2) + \beta_{i2}X_{1it-1} + \epsilon_{it}$$

as before.

The Durbin - Watson statistics for the Sargan - Bhargava test were derived from the regressions :

$$C_{it} = \beta_0 + \epsilon_{it}$$

and

$$X_{1it} = \beta_0 + \epsilon_{it}$$

Analogous to the earlier tests, the null hypothesis is that there exists a unit root in the time series [that is C_{it}, X_{it}~I(1)] against the alternative that C_{it}, X_{it}~I(0). With a 5% test size and eleven observations, however, the critical value is 1.733. Where the null could not be rejected, tests were re-run in differences such that:

$$\delta\ C_{it} = \beta_0 + \epsilon_{it}$$

and

$$\delta\ X_{1it} = \beta_0 + \epsilon_{it}$$

In this case the null is that C_{it}, X_{1it}~I(2) against the alternative that C_{it}, X_{1it}~I(1).

The results for these tests are reported in Tables 12.1 & 12.2. It is immediately apparent that the results are not as robust as those reported in the previous section. In particular, in 25 cases the compensation and parent company share price variables do not appear to be integrated of the same order. For example, in the case of Allied-Lyons, while we can reject the null that the share price is integrated of order 2 in favour of the alternative that it is I(1) (the Durbin - Watson statistic is greater than 1.733), we cannot similarly reject the null that compensation paid to the highest paid director at Allied-Lyons is I(2) against the alternative. The implication is that the first condition for cointegration is not uniformly satisfied. The tentative nature of these results must of course be stressed once again.

For the second condition for cointegration that there exists a cointegration vector for :

$$X_{it} = \alpha_{i0} + \alpha_{i1}C_{it} + \epsilon_{it}$$

such that ϵ_{it}~I(0), Durbin - Watson statistics were derived from the regression :

$$Z_{it} = \beta_0 + \epsilon_{it}$$

where

$$Z_{it} = C_{it} - X_{it}$$

(that is, the log of compensation less the log of the parent company's share price). With the limited amount of data available, the results (Tables 12.1 & 12.2) appeared to suggest that the second condition for cointegration was not satisfied either. In general, it was not possible to reject the null hypothesis that ϵ_{it} ~ I(1). Furthermore, this condition did not appear to differ in those companies that did employ stock option contracts. In Table 12.1 containing companies which did not employ such contracts it was only possible to reject the null hypothesis in 3 out of 23 cases. In table 12.2 containing companies which did employ such contracts, it was only possible to reject the null in 4 out of 24 cases.

12.3 <u>INTERPRETATION OF RESULTS</u>

The analysis in this chapter has demonstrated a method which can usefully be employed to distinguish between spurious and non spurious relationships between compensation and corporate performance. While the results necessarily remain tentative, given the shortage of observations, the conclusions to emerge in this work are clear. It remains for future work to corroborate the conclusions when more information becomes available.

The fact that neither the first, nor second conditions for cointegration appeared to be satisfied, suggests that there is no stable relationship between executive compensation and corporate performance. Taken in conjunction with the results reported in Chapter 11, the implication is that while companies may be able to achieve a sustained competitive advantage, the compensation contracts employed have not been a successful means of obtaining such advantage. Of course, the analysis reveals nothing about optimality of the contracts employed. It may well be that scope for competitive advantage through the use of optimal compensation contracts does exist. However, the complexities of such contracts alluded to in the first part of this thesis appear so far to have prevented practical implementation. The suggestion is that external routes to competitive advantage might be more effective.

COMPANIES THAT DO NOT PROVIDE SHARE OPTION PLANS

TABLE 12.1

COMPANY	COMPENSATION (Cit) DW1	COMPENSATION (Cit) DW2	SHARE PRICE (Xit) DW1	SHARE PRICE (Xit) DW2	(Cit-X1it) DW1
ALLIED-LYONS	0.39	1.23	0.23	2.12	0.99
ASSD.BRIT FOODS	0.21	0.92	0.22	1.24	0.34
BASS	0.21	1.95	0.17	2.50	0.45
BAT INDS.	0.29	2.42	0.20	2.82	0.29
BEECHAM GROUP	0.79	2.07	0.32	2.36	1.85
BLUE CIRCLE IND	0.27	3.25	0.40	1.49	1.33
BOOTS	0.18	1.75	0.34	2.74	1.47
BPB INDUSTRIES	0.20	1.51	0.21	1.65	0.75
BRIT. PETROLEUM	0.17	2.87	0.34	1.89	1.20
COURTAULDS	0.32	0.97	0.23	2.35	0.60
ENG. CHINA CLAYS	1.96	3.03	0.19	2.71	2.03
GLAXO HLDGS	0.25	2.37	0.18	2.07	0.33
HAWKER SIDDELEY	0.55	2.51	0.30	0.83	1.04
PILKINGTON BROS	0.31	1.32	0.54	2.29	1.52
RACAL ELECTRONIC	0.35	1.15	1.04	2.02	1.00
RANK HOVIS	0.17	0.74	0.18	2.33	0.29
RECKITT & COLMAN	0.16	1.78	0.16	1.82	0.36
ROTHMANS INL B	0.19	1.71	0.38	2.14	1.68
ROWN TREE	0.16	2.40	0.23	2.30	1.43
SEARS	0.15	1.53	0.22	2.66	2.10
THORN EMI	0.25	1.37	0.87	2.44	0.99
TRUSTHOUSE FORTE	0.33	1.07	0.20	2.97	0.98
UNILEVER	0.17	2.22	0.16	2.22	0.38

Footnote :

dw_1 derived from $C_{it} = \beta_o + \epsilon_{it}$, $X_{it} = \beta_o + \epsilon_{it}$
$Z_{it} = \beta_o + \epsilon_{it}$

dw_2 derived from $\delta C_{it} = \beta_o + \epsilon_{it}$, $\delta X_{it} = \beta_o + \epsilon_{it}$
$\delta Z_{it} = \beta_o + \epsilon_{it}$

TABLE 12.2

COMPANY	COMPENSATION (Cit) DW1	COMPENSATION (Cit) DW2	SHARE PRICE (Xit) DW1	SHARE PRICE (Xit) DW2	(Cit-Xlit) DW1
BOC GROUP	0.49	0.76	0.28	1.90	1.56
BTR	0.15	1.25	0.18	1.21	0.85
BUNZL	0.25	2.49	0.16	1.02	0.57
BURTON GROUP	0.14	1.56	0.19	1.14	0.92
CADBURY SCHWEPPS	0.32	1.94	0.21	3.09	1.17
DIXONS	0.17	1.83	0.21	1.69	1.23
FISONS	0.15	1.68	0.21	1.28	0.40
GRANADA GROUP	0.20	2.24	0.52	1.59	0.24
GRAND METROPLTN	1.58	2.99	0.21	2.42	2.03
HANSON TRUST	0.30	1.91	0.19	1.86	1.24
IMP. CHEM.INDS	0.36	1.93	0.24	1.68	1.52
LADBROKE GROUP	0.24	2.03	0.22	1.42	1.61
MARKS & SPENCER	0.17	1.62	0.26	2.62	1.83
PERSONS	0.47	2.41	0.13	0.72	0.60
PLESSEY	0.29	1.36	0.39	0.83	0.91
RANK ORG.	0.20	2.02	0.38	1.92	1.17
REDLAND	0.15	1.65	0.22	2.43	1.72
REED INTL.	0.18	2.62	1.41	2.97	1.72
SHELL TRANSPORT	1.05	1.54	0.35	2.60	1.02
TARMAC	0.16	1.42	0.20	1.92	0.62
TESCO	0.26	2.00	0.20	1.76	0.75
TRAFALGAR HOUSE	0.18	1.86	0.19	1.00	0.52
UNITED BISCUITS	0.16	1.45	0.19	2.44	1.50
WHITBREAD A	0.59	1.48	0.36	3.49	0.42

Footnote :
dw_1 derived from $C_{it} = \beta_0 + \epsilon_{it}$, $X_{it} = \beta_0 + \epsilon_{it}$
$Z_{it} = \beta_0 + \epsilon_{it}$

dw_2 derived from $\delta C_{it} = \beta_0 + \epsilon_{it}$, $\delta X_{it} = \beta_0 + \epsilon_{it}$
$\delta Z_{it} = \beta_0 + \epsilon_{it}$

PART V - CONCLUSION

CHAPTER 13

CONCLUSION

The central concern of this thesis has been the means whereby a firm might gain a sustained competitive advantage over its rivals. The subject has largely been brought to public attention by the business strategy literature. It has been argued that this literature might be able to provide useful insights for managers seeking competitive advantage, but falls short of providing a formal framework for analysing competitive advantage.

This thesis has explored the formal analysis contained within two broad strands of literature. The first strand yields the conjecture that firms may gain a competitive edge through the use of superior compensation contracts. The question of the optimal contract has been the chief concern of principal - agent theory. The theory suggests that the optimal contract will be highly complex. While some empirical evidence has emerged in recent years pointing to a significant positive relationship between compensation and firm performance, it has been argued that the results may be misleading. In particular, it was suggested that the issue of causality has not been adequately addressed and that there has been a concentration on cross-section evidence to the neglect of time series evidence.

The second route this thesis has explored through which firms might gain a sustained competitive advantage is through external market moves. The conjecture here is that most markets do not satisfy the conditions for strict contestability. In non - contestable markets scope may exist for firms to pursue strategic market moves to gain such a competitive advantage. For a strategic move to be successful, the move must influence other firms' expected payoffs from the various courses of action open to them. Two broad types of strategic move were identified : those which altered in a lasting way cost or demand conditions; and those which influenced the beliefs of those whose behaviour they were designed to affect. In the former case, it was argued that the scope for strategic use of investment in capacity, R&D and advertising was a function of the nature of market competition and of the investments themselves. In the latter case, given the existence of less than perfect information, it was suggested that firms may well engage in predatory practices to gain a reputation for toughness amongst other firms in the market, and those who might be contemplating entry.

The empirical section of the thesis offered an assessment of the avenues through which a firm might gain a competitive advantage, and asks whether competitive advantage is sustainable over time. The major point of departure in the empirical work was to use cointegration techniques to examine the time-series properties of some of the key variables involved. In particular, two questions were asked: in the experience of the top 100 U.K. companies between 1970 and 1987, was there any tendency for company share prices to converge on an equilibrium relationship with that of the industry in which they operated or the market as a whole?; and during the same time span, was there any tendency for executive compensation to converge onto an equilibrium relationship with the performance of the company? The largely unequivocal answer appears to be in the negative, in both cases the implication being that while there may be scope for companies to achieve a sustained competitive advantage over rivals, the compensation contracts employed have not been the means through which this advantage has been achieved. The suggestion is that external routes to competitive advantage might be more effective.

In the absence of sufficient observations, it remains for future work to corroborate the conjecture that there does not exist a stable, non-spurious relationship between executive compensation and corporate performance. It also remains for future empirical investigation to explore and differentiate between the external strategic market moves that firms may emply to achieve a sustained competitive advantage.

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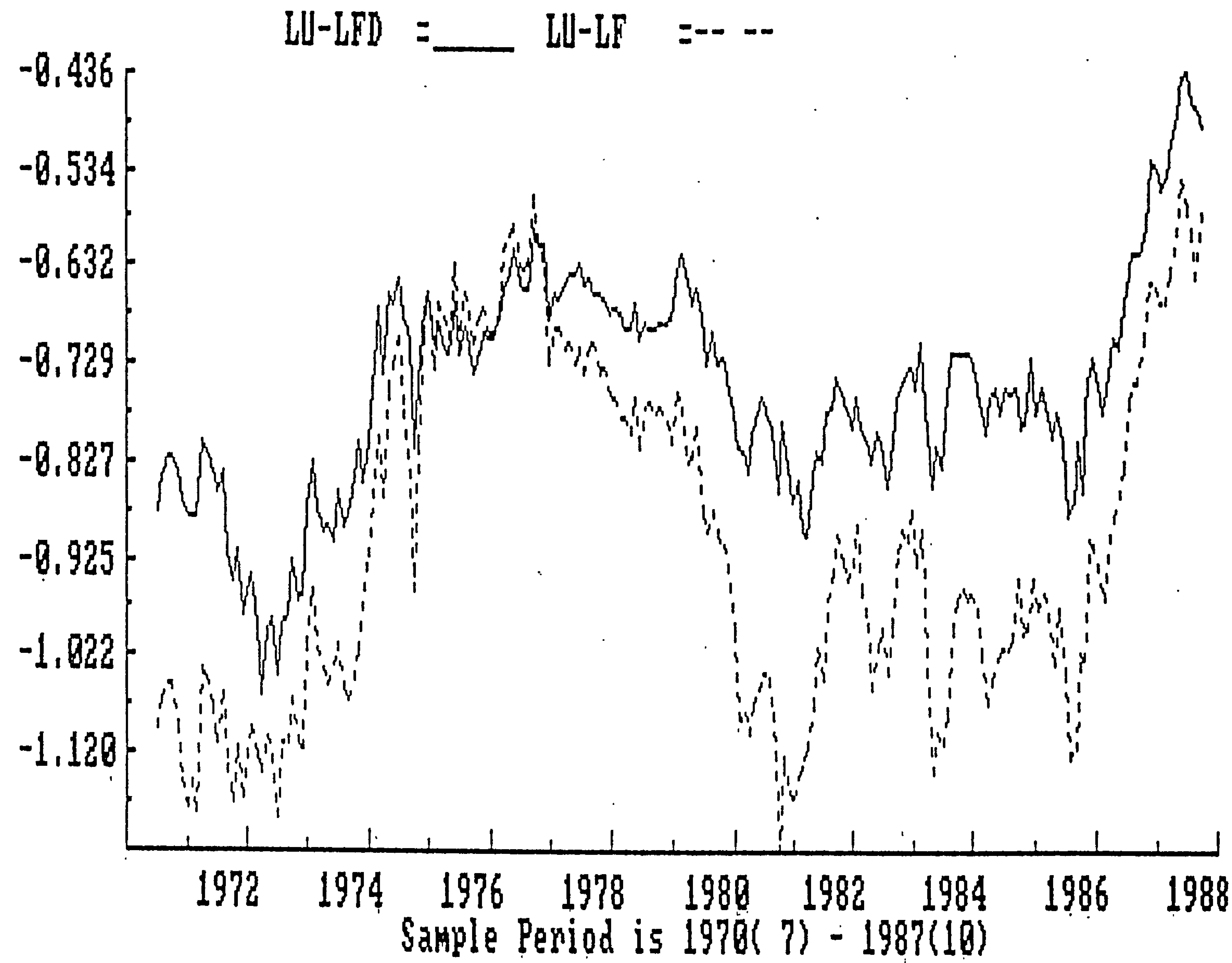
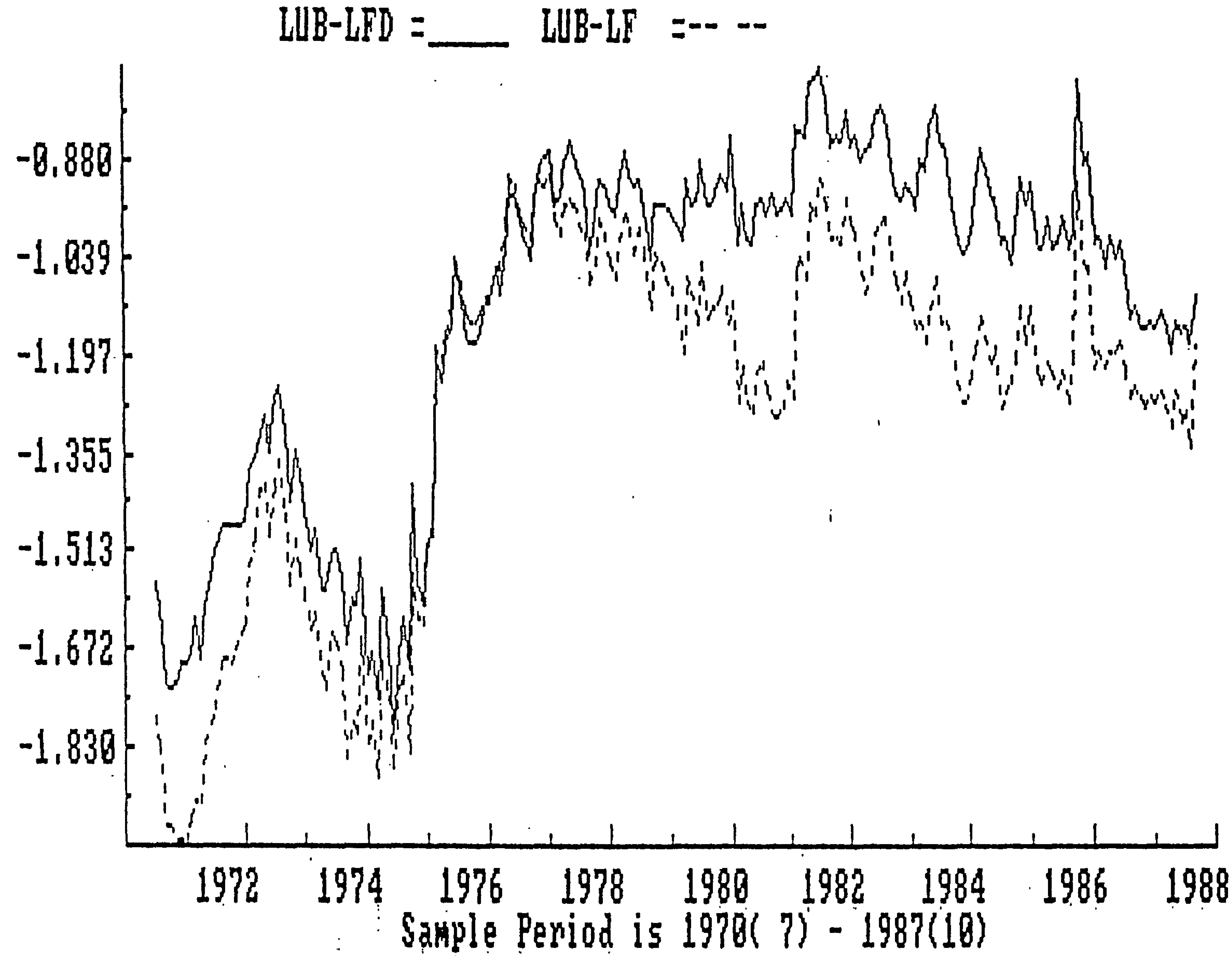
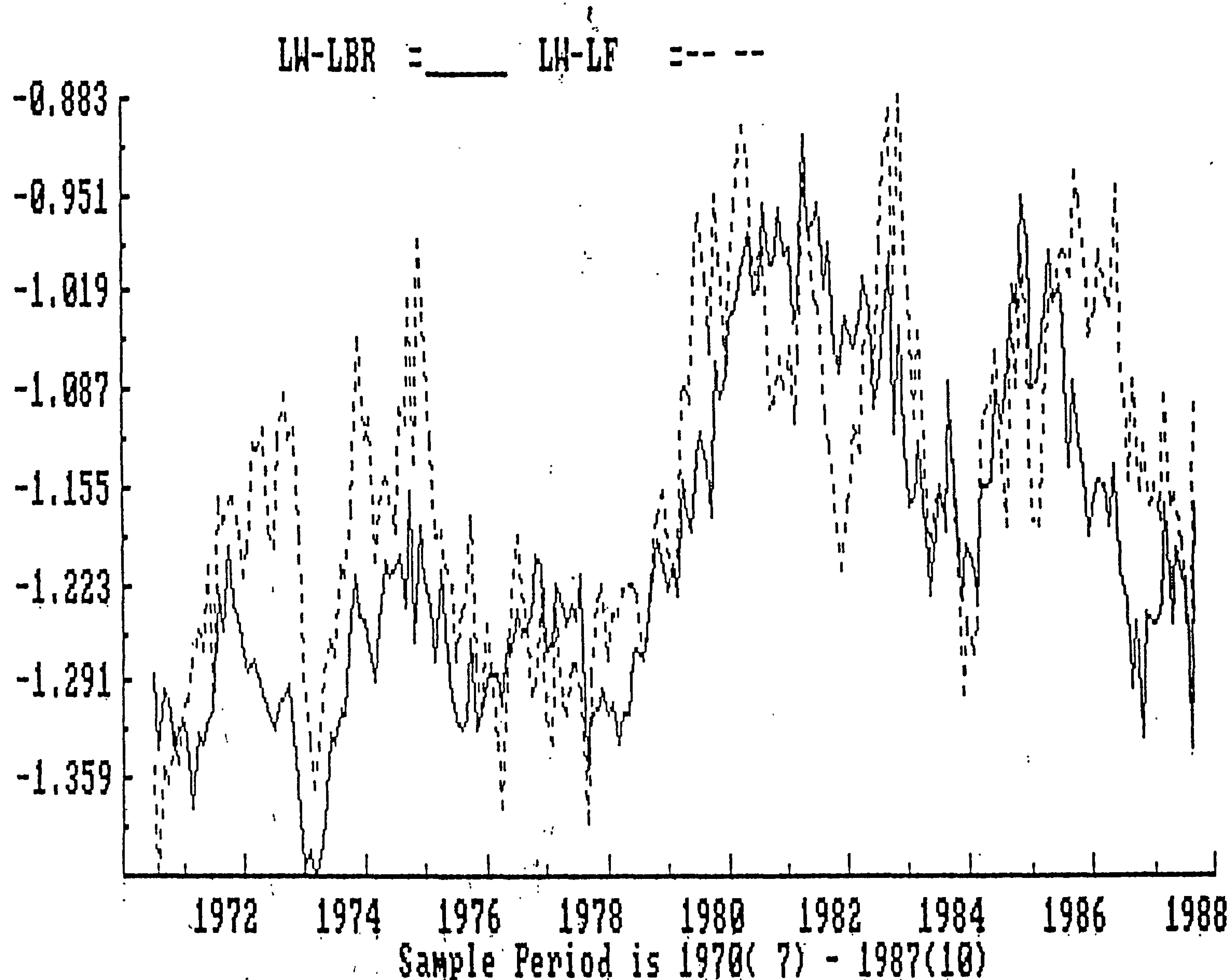
APPENDIX A

Share price of individual companies related to average share price of companies in the industry in question and to the FT index.


LU-LFD =____ LU-LF =-- --
-0.436
-0.534
-0.632
-0.729
-0.827
-0.925
-1.022
-1.120
1972
1974
1976
1978
1980
1982
1984
1986
1988
Sample Period is 1970(7) - 1987(10)


LUB-LFD =____ LUB-LF =-- --
-0.880
-1.039
-1.197
-1.355
-1.513
-1.672
-1.830
1972
1974
1976
1978
1980
1982
1984
1986
1988
Sample Period is 1970(7) - 1987(10)



LW-LBR =____ LW-LF =-- --
-0.883
-0.951
-1.019
-1.087
-1.155
-1.223
-1.291
-1.359
1972
1974
1976
1978
1980
1982
1984
1986
1988
Sample Period is 1970(7) - 1987(10)

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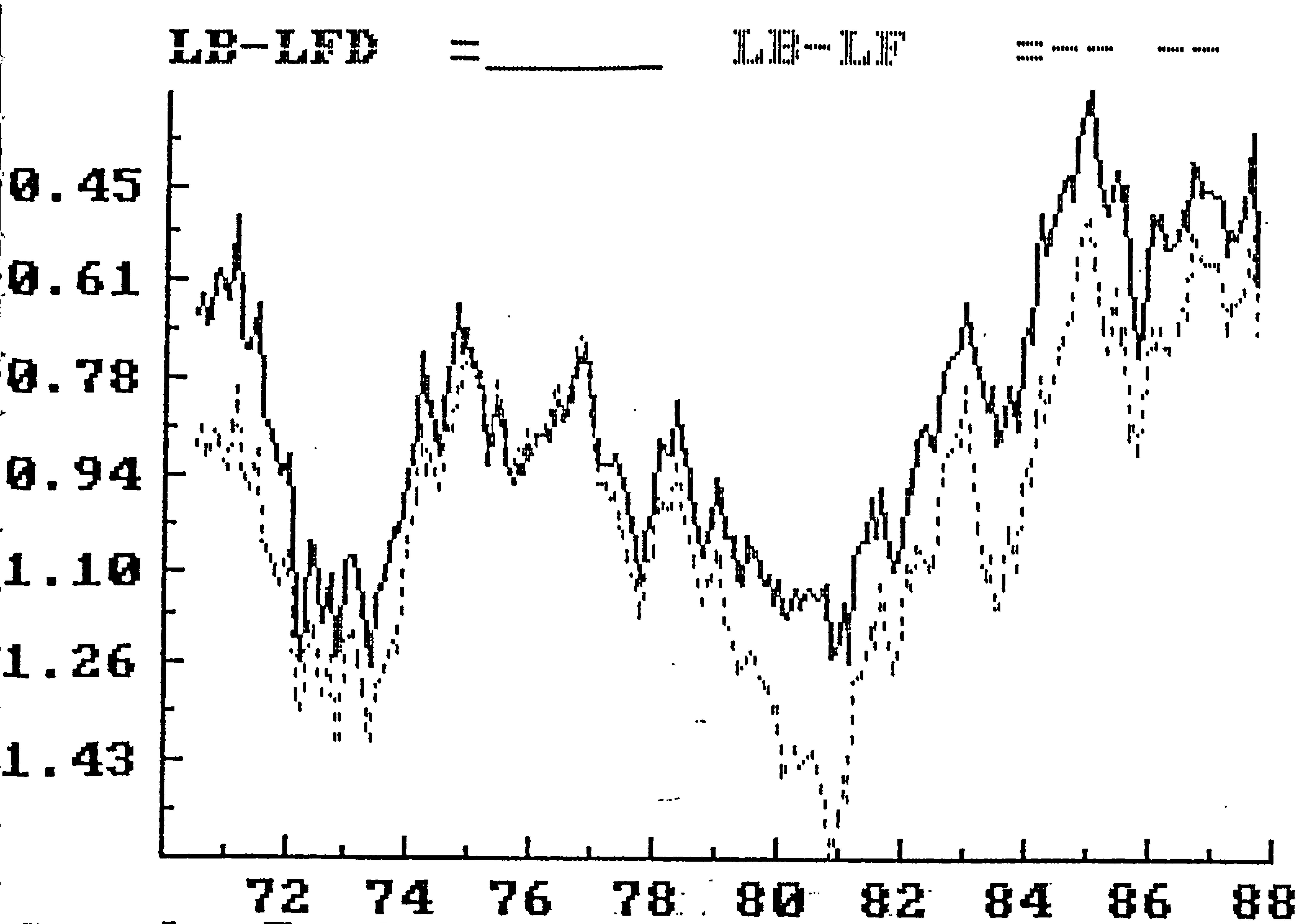

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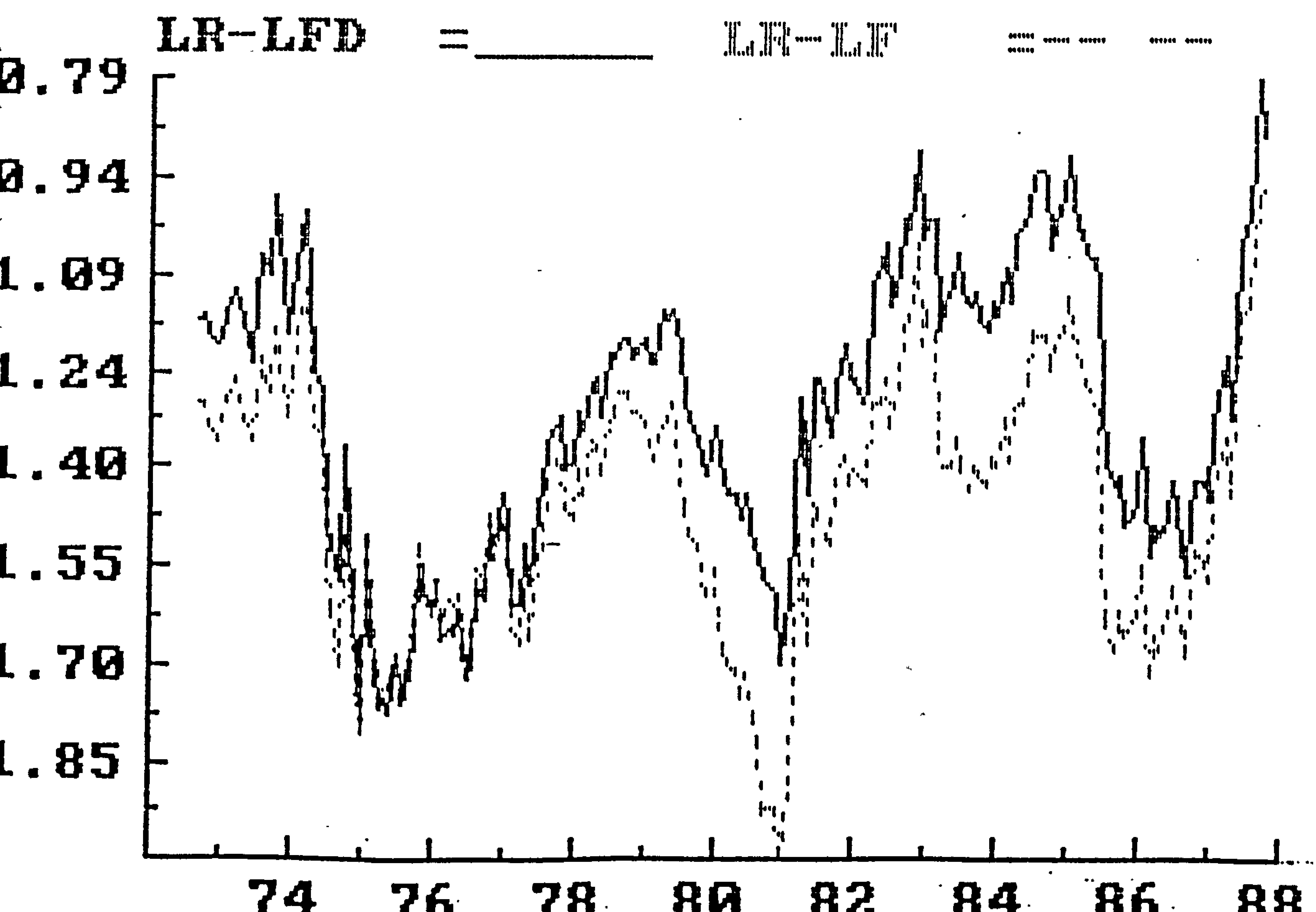

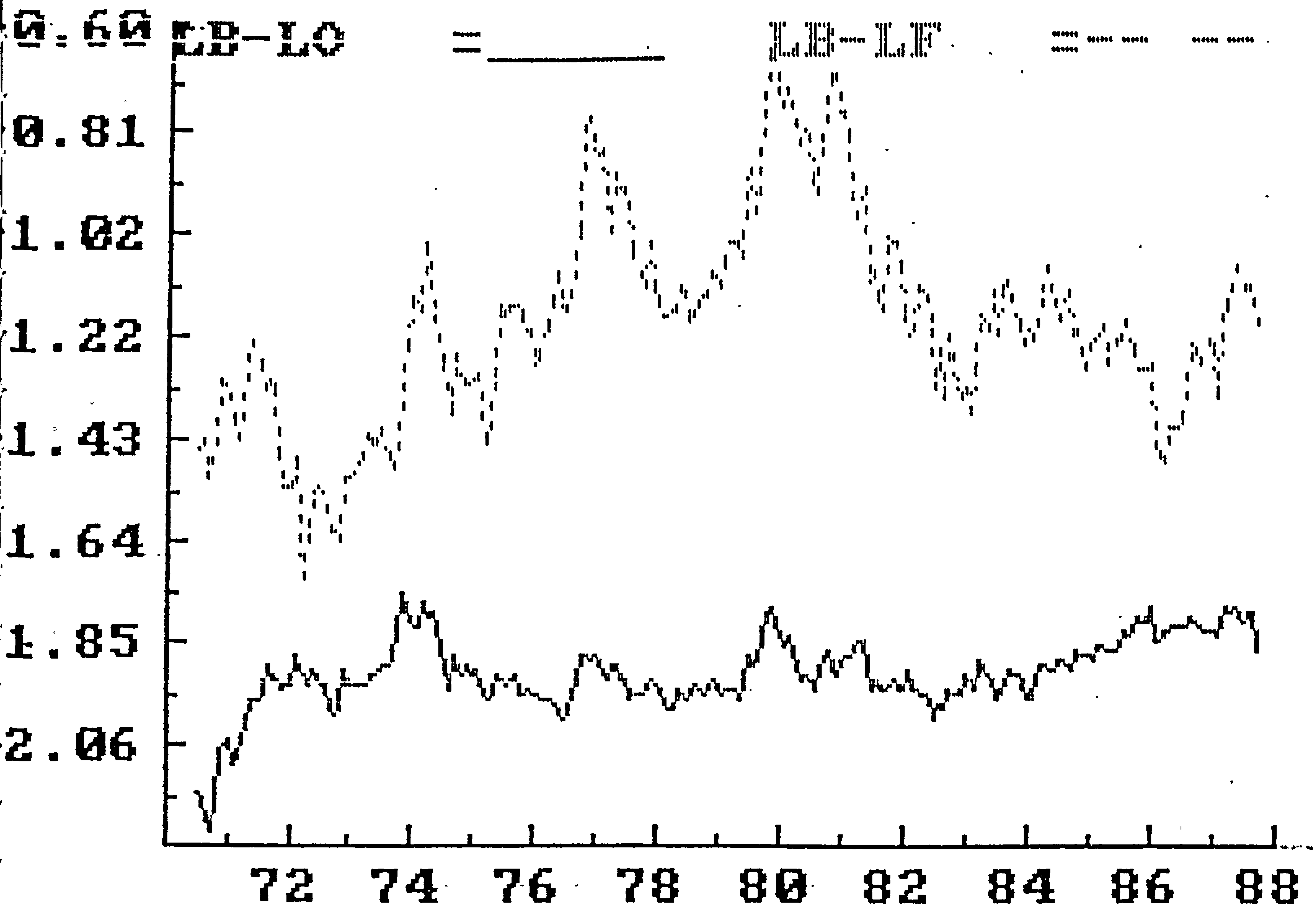

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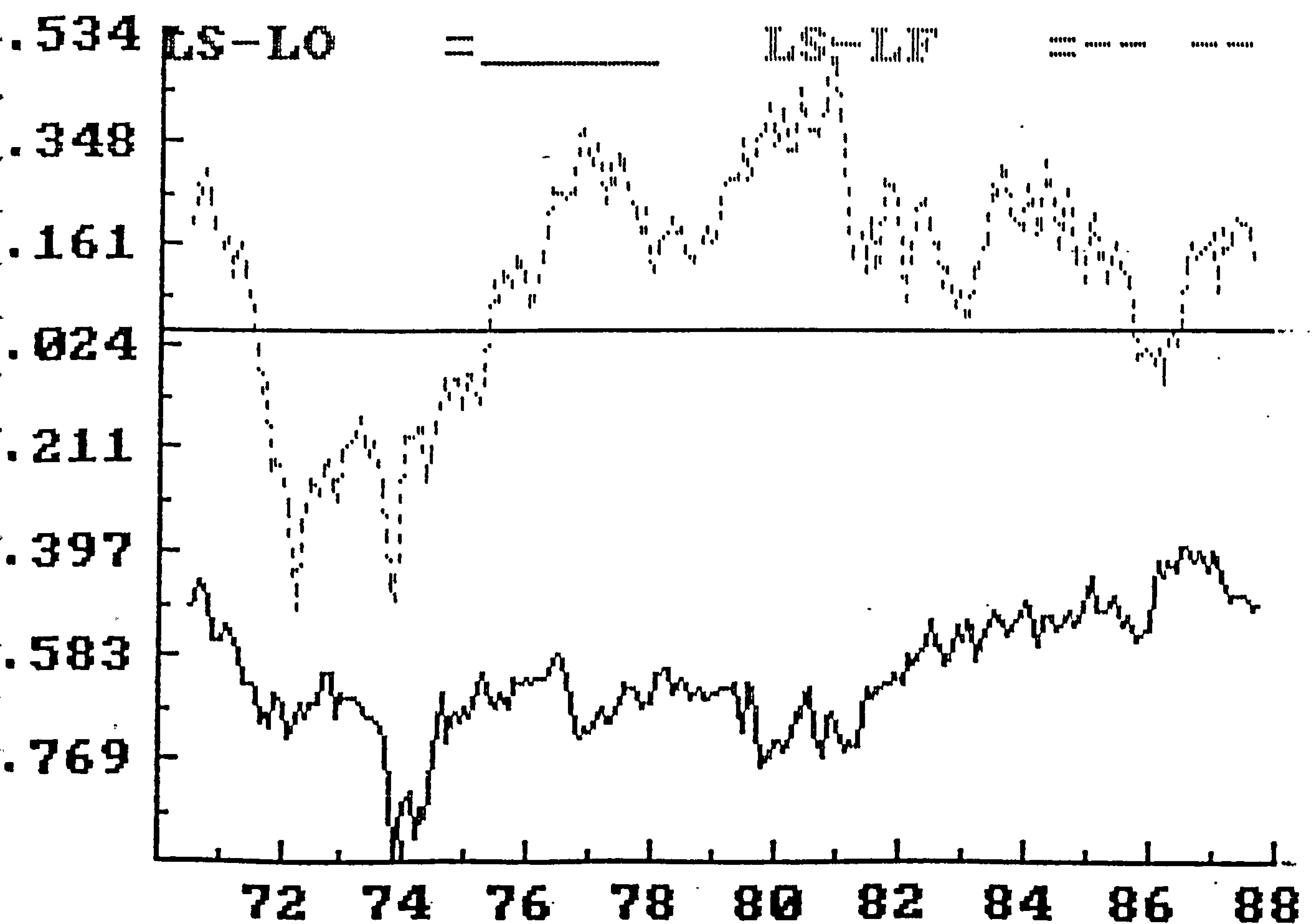

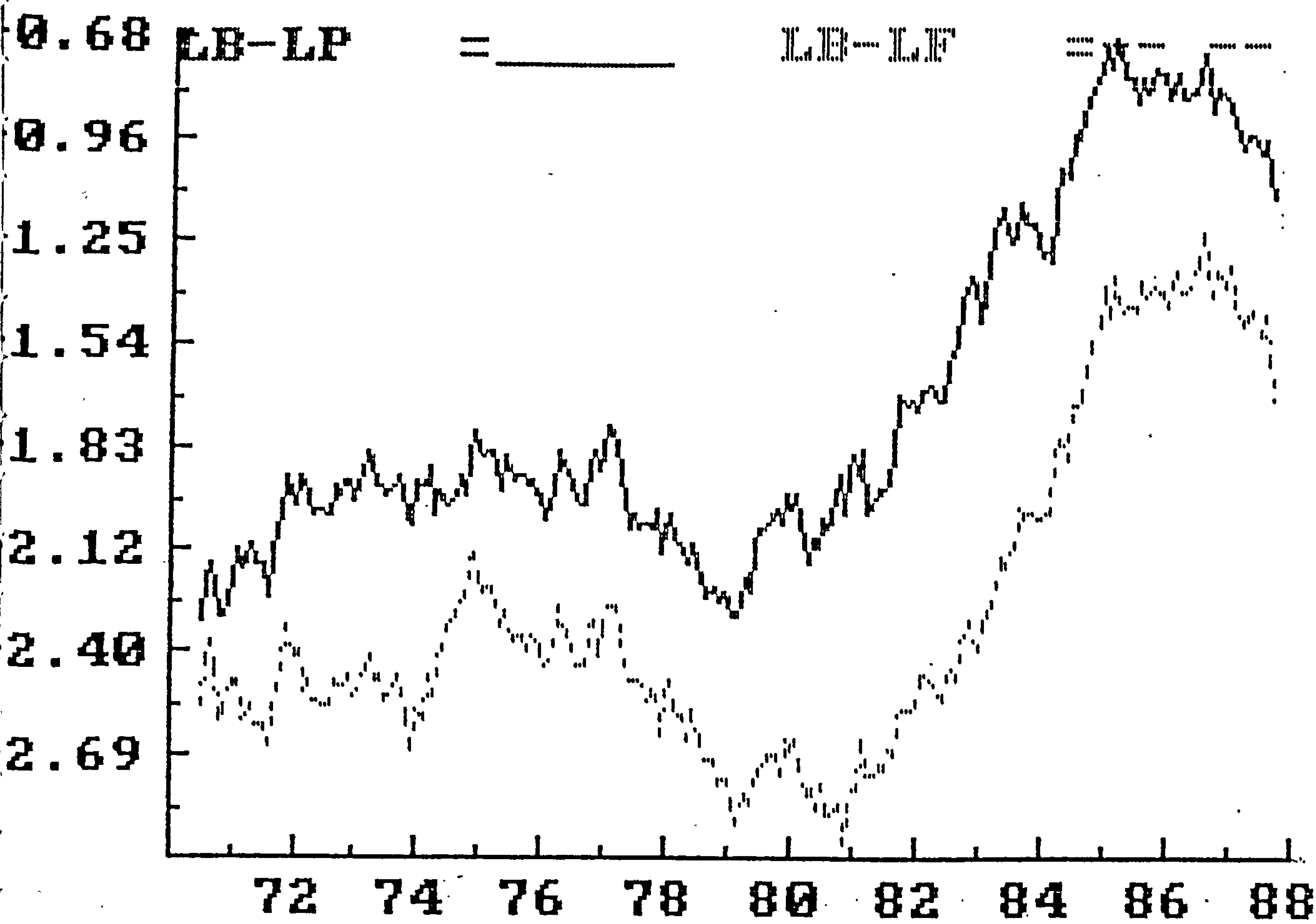

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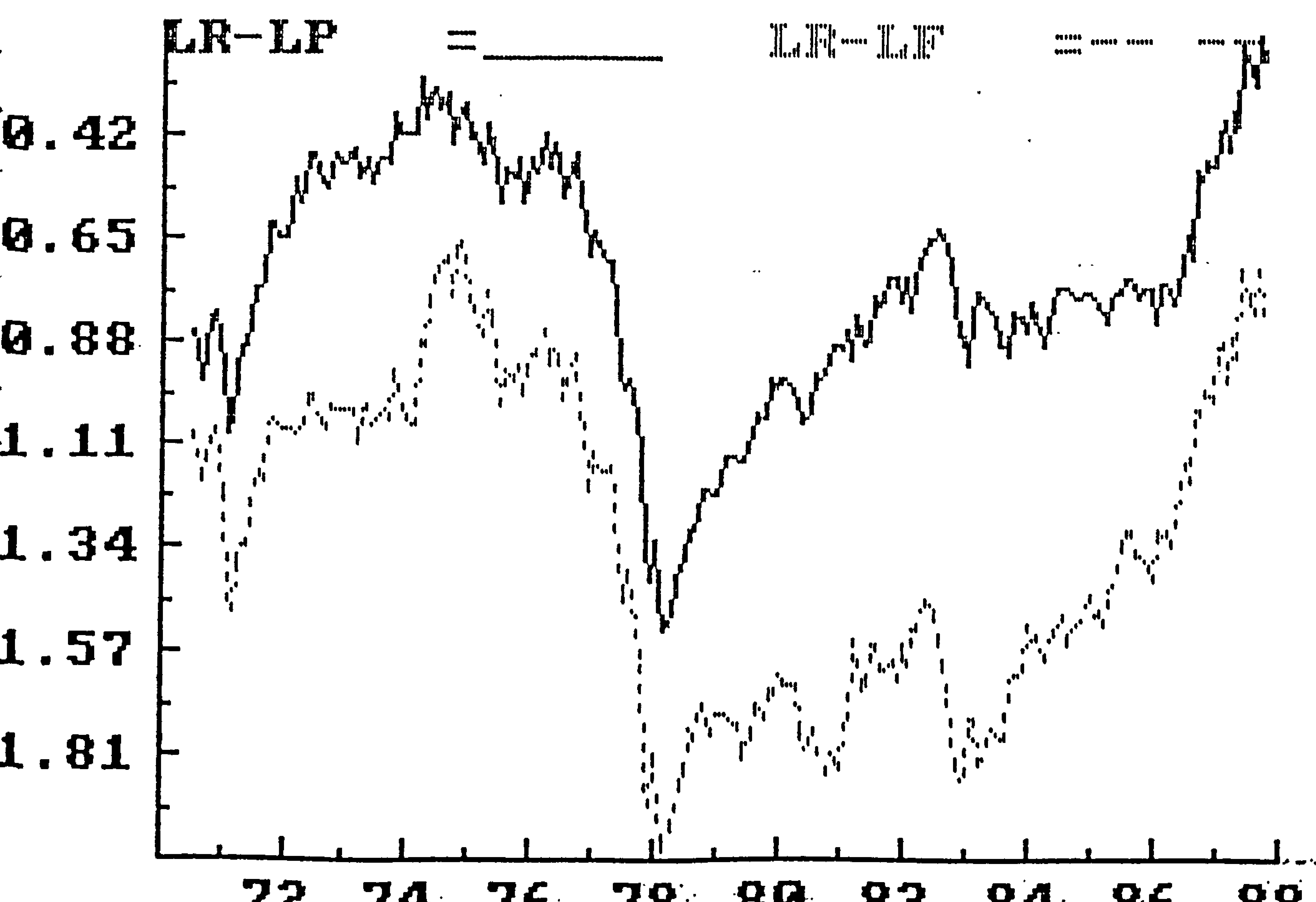

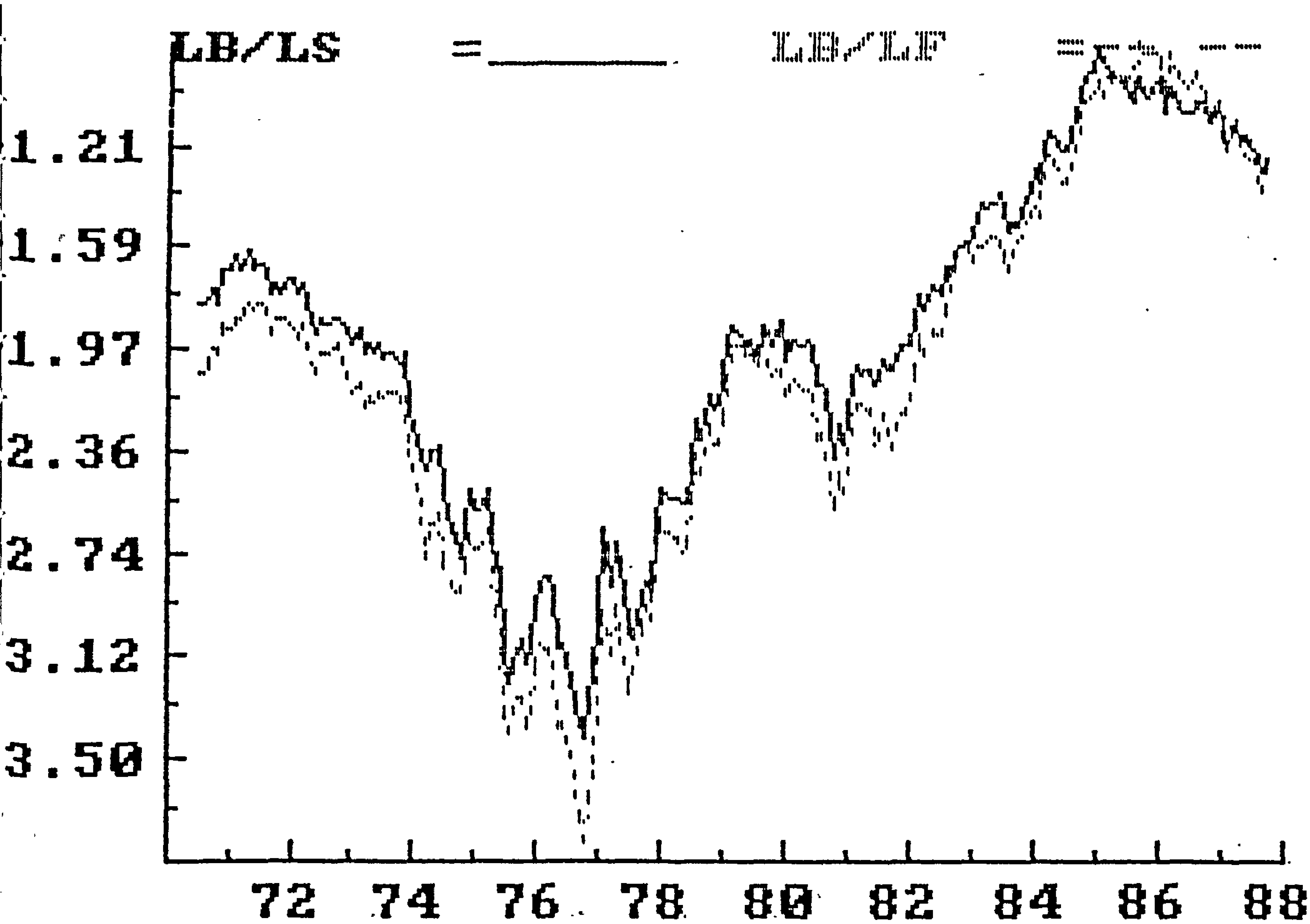

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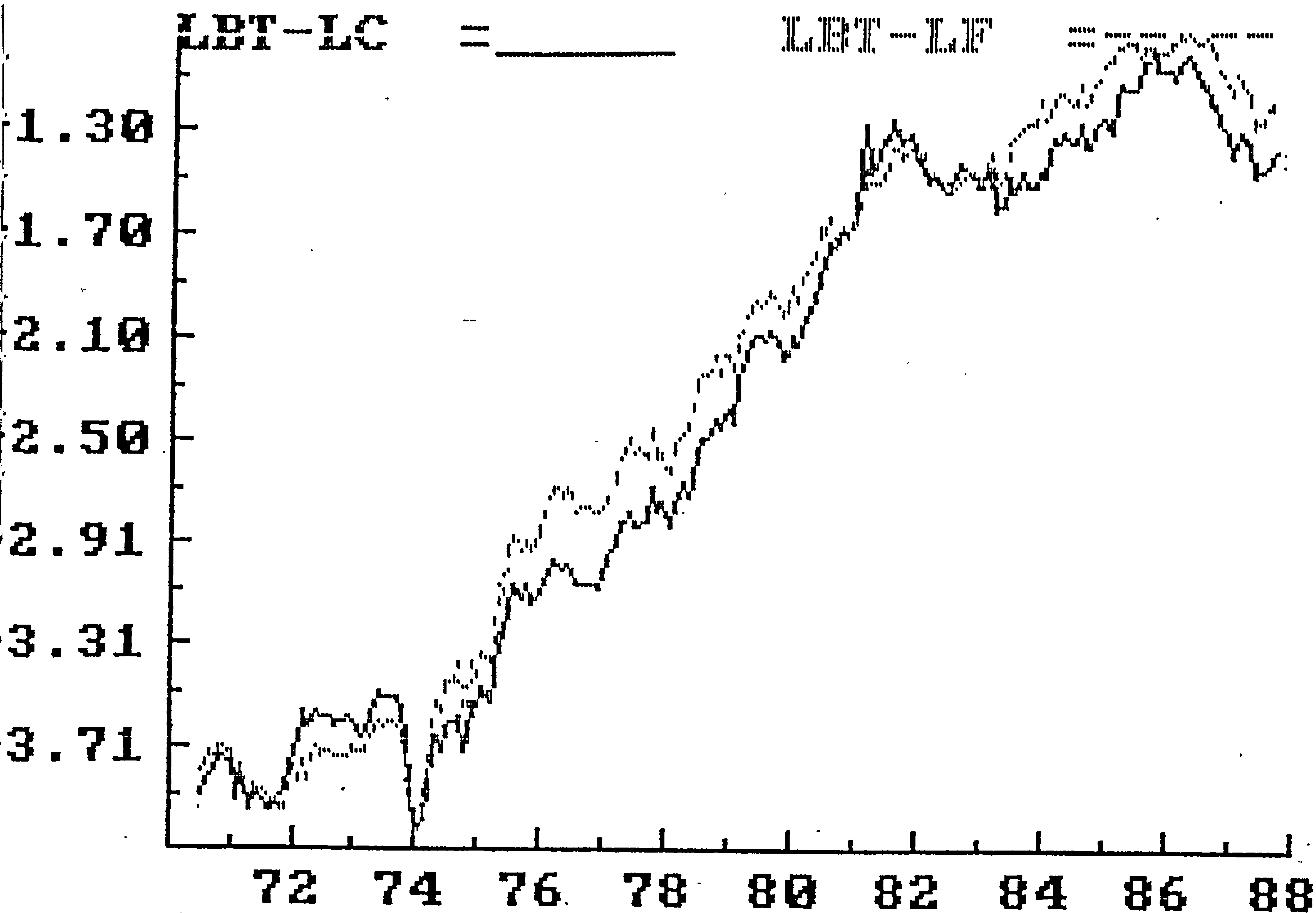

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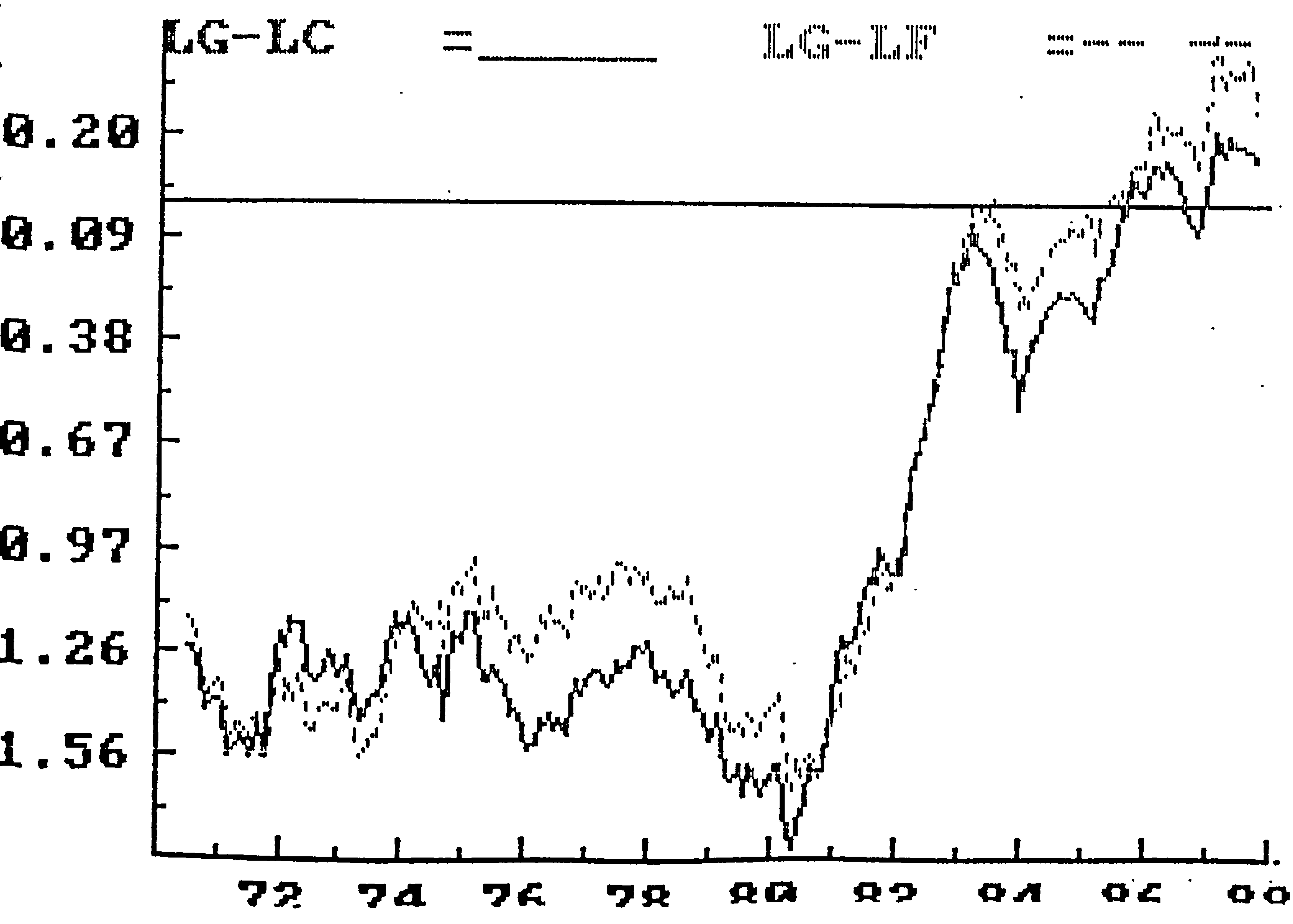
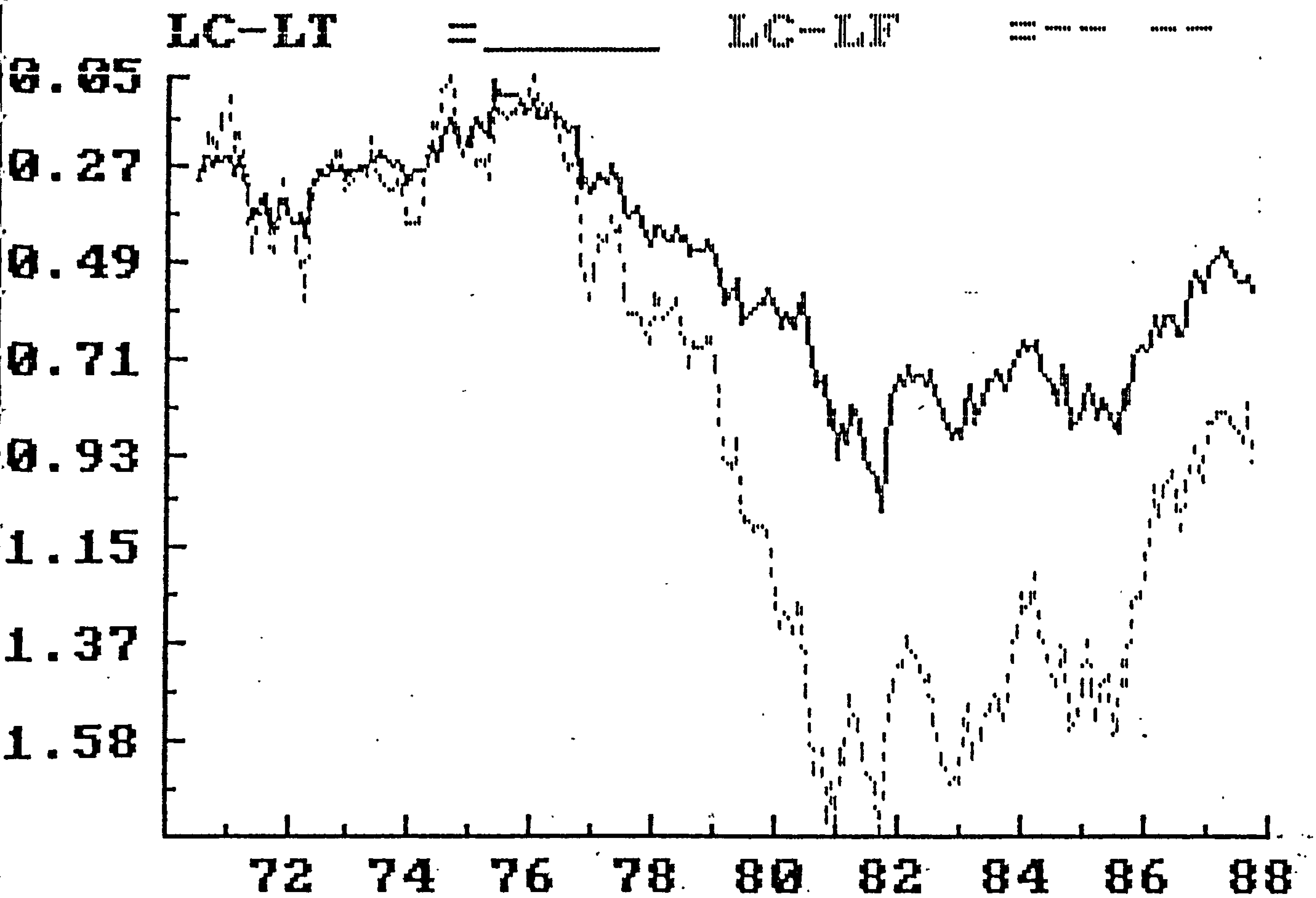
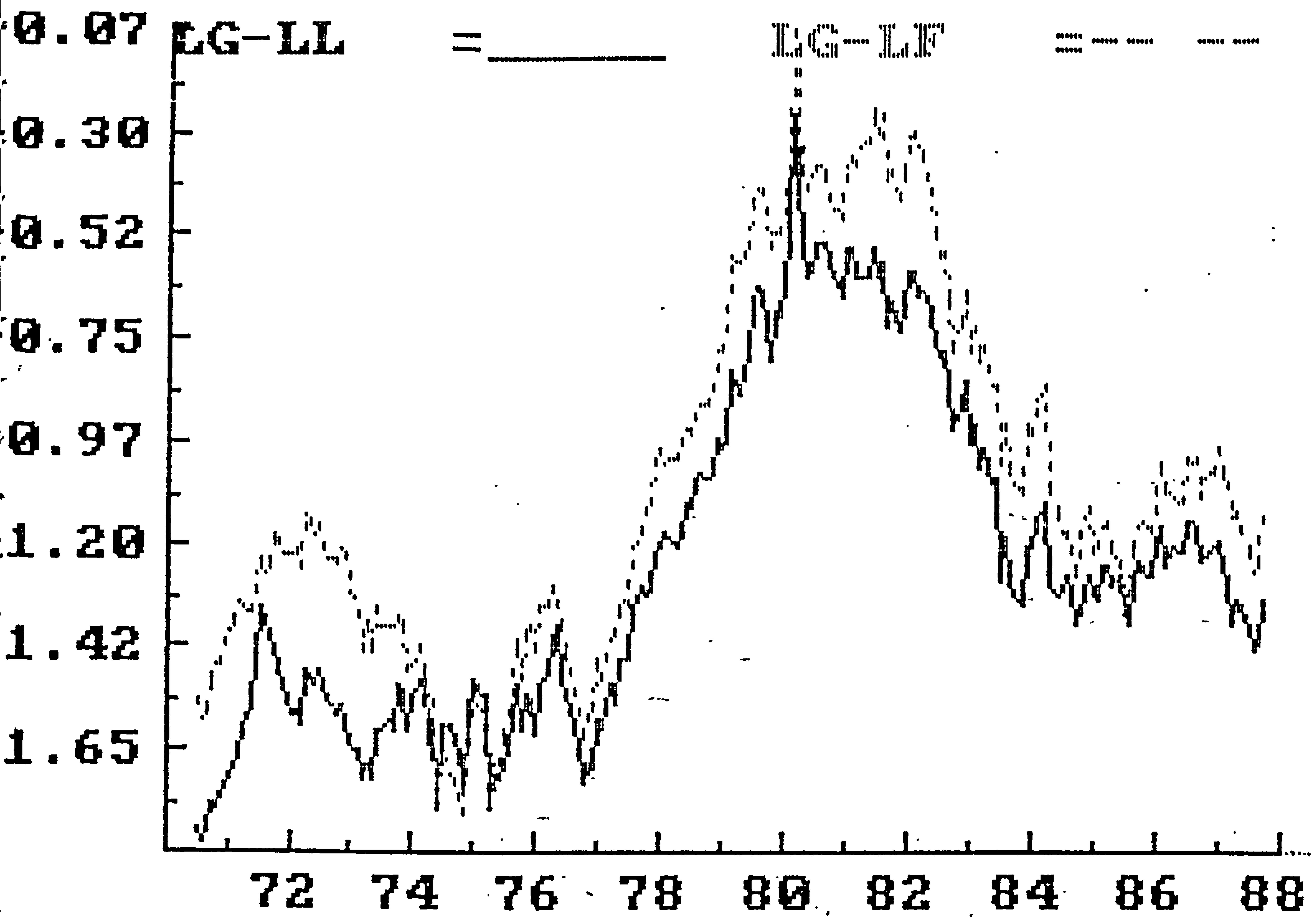
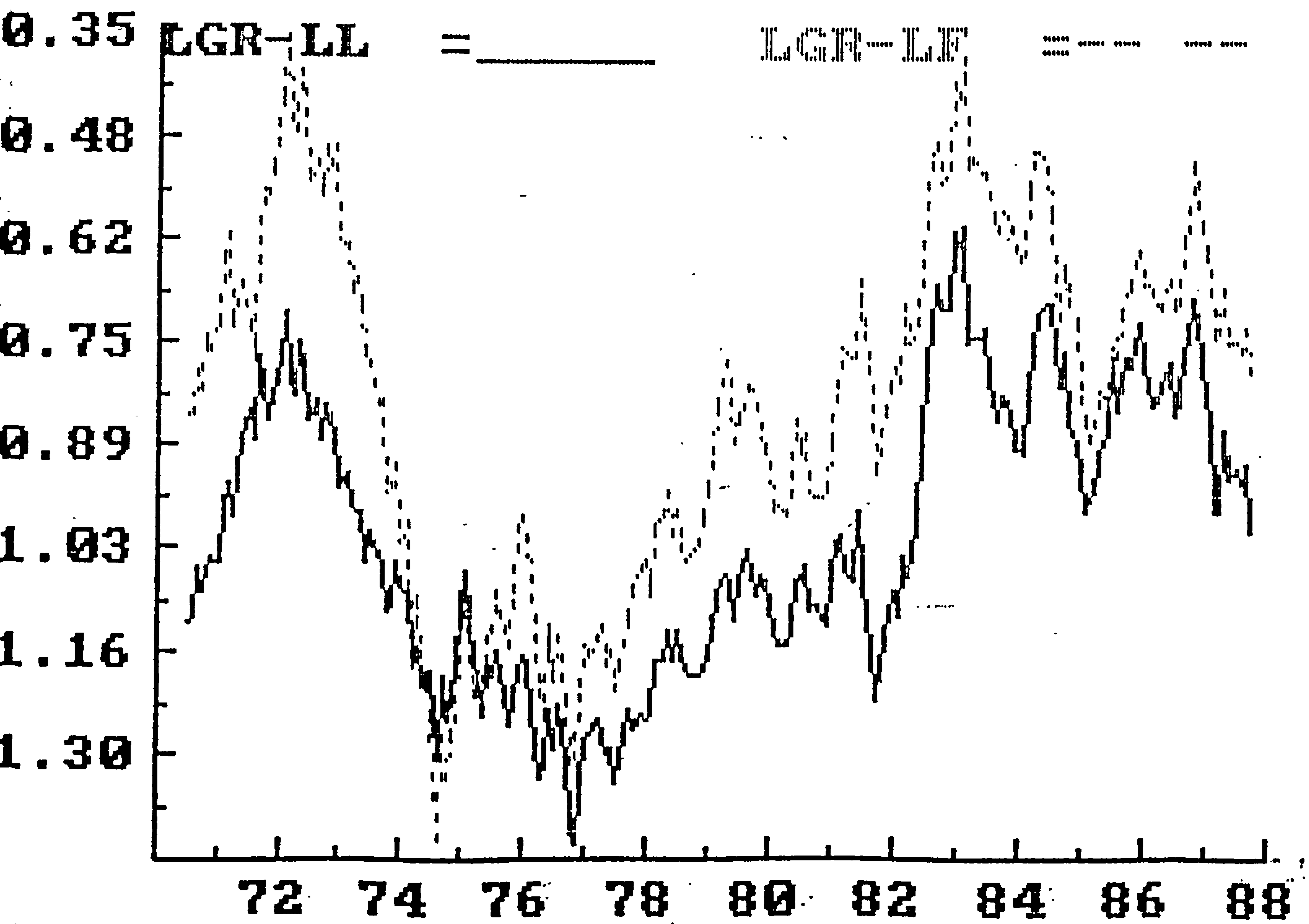




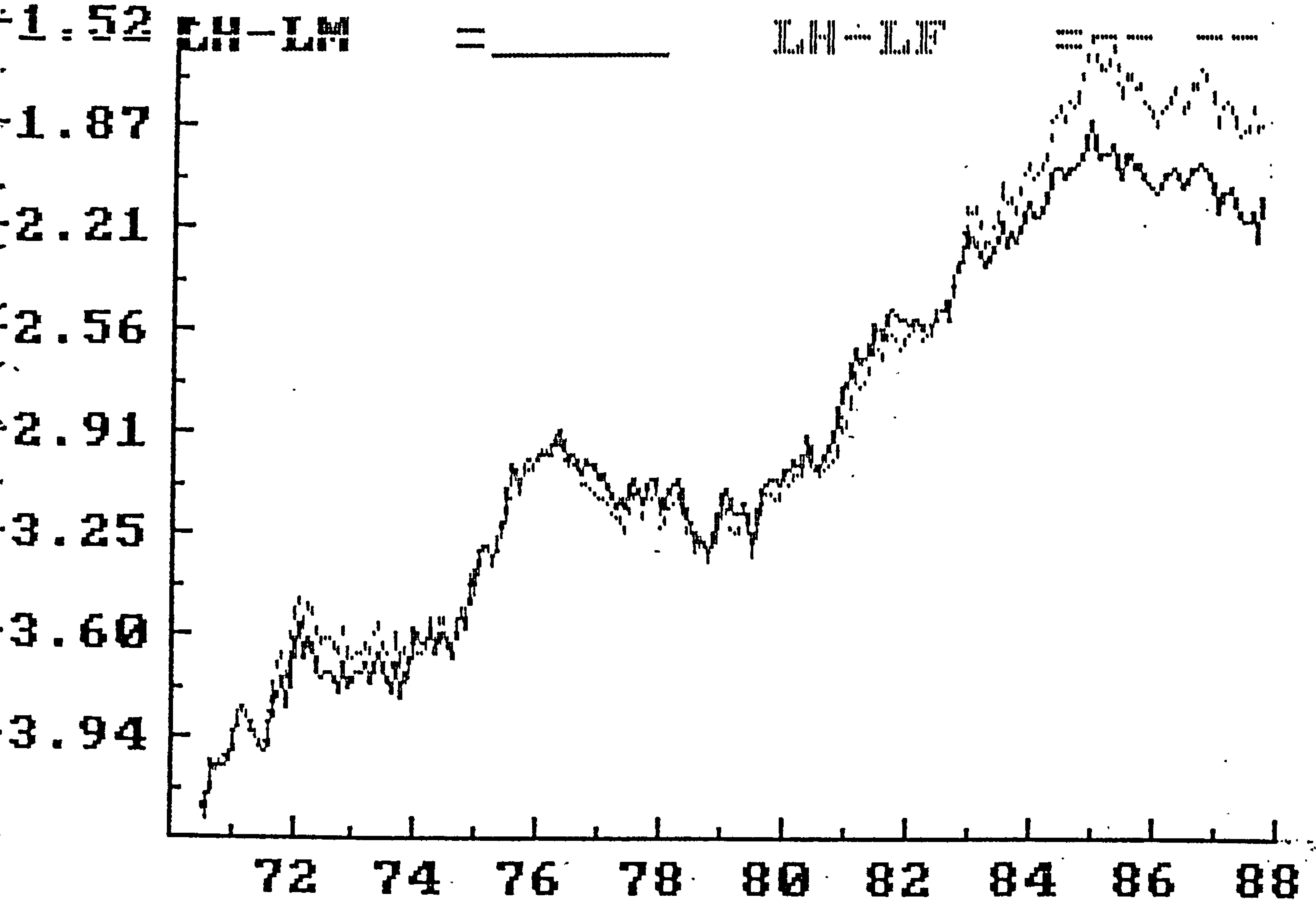
Sample Period is 1970(7) - 1987(10)



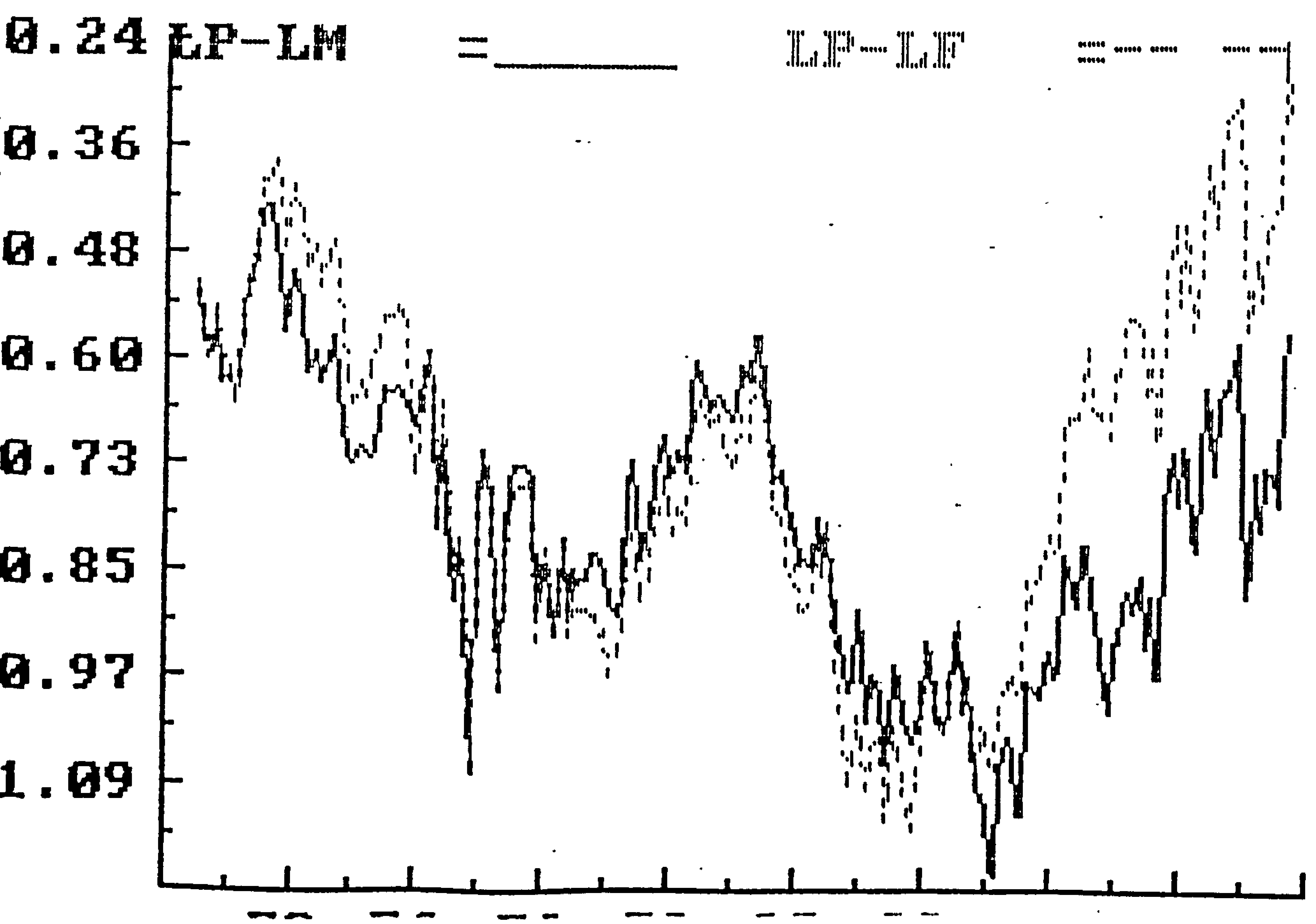
Sample Period is 1970(7) - 1987(10)

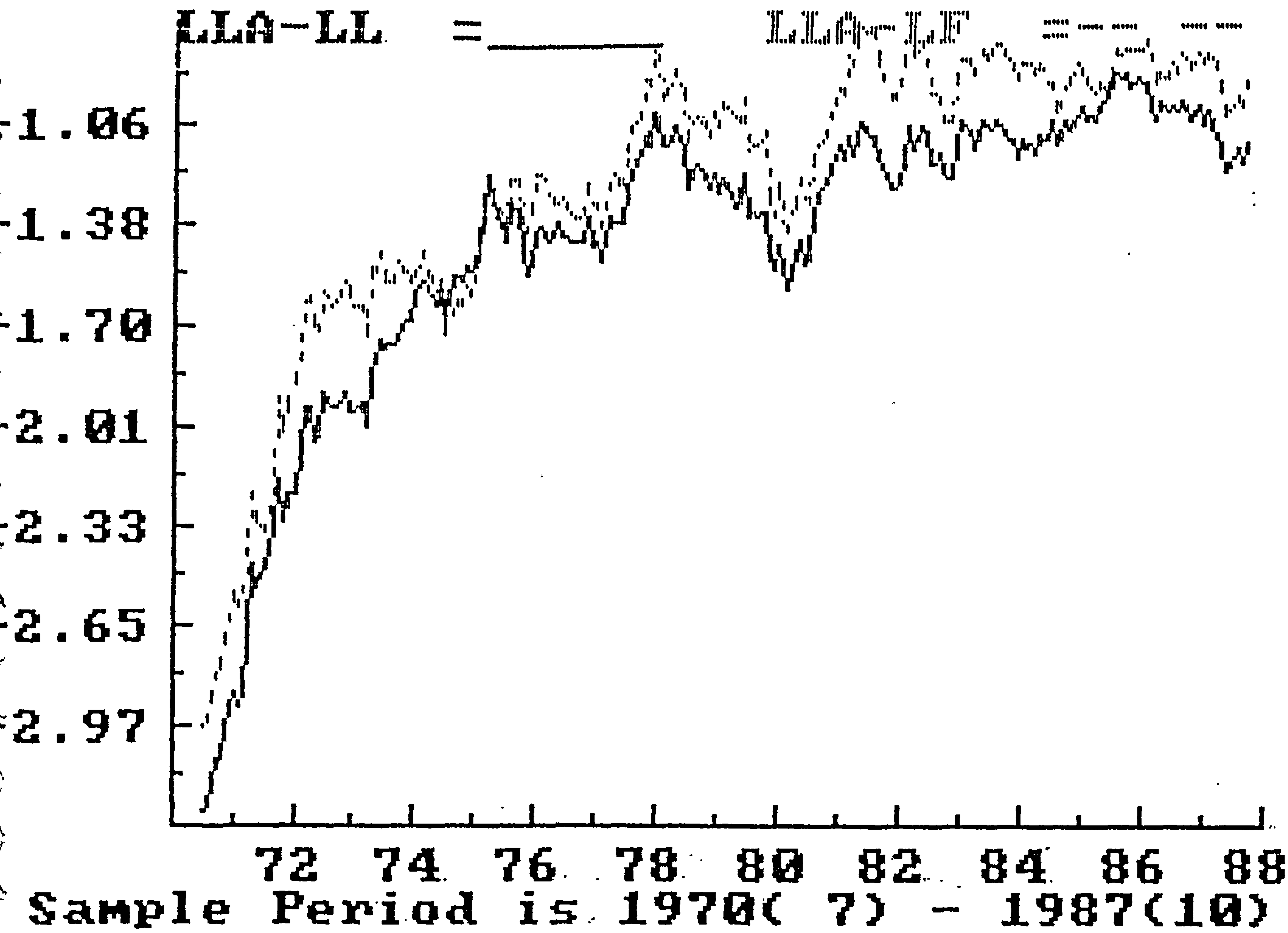


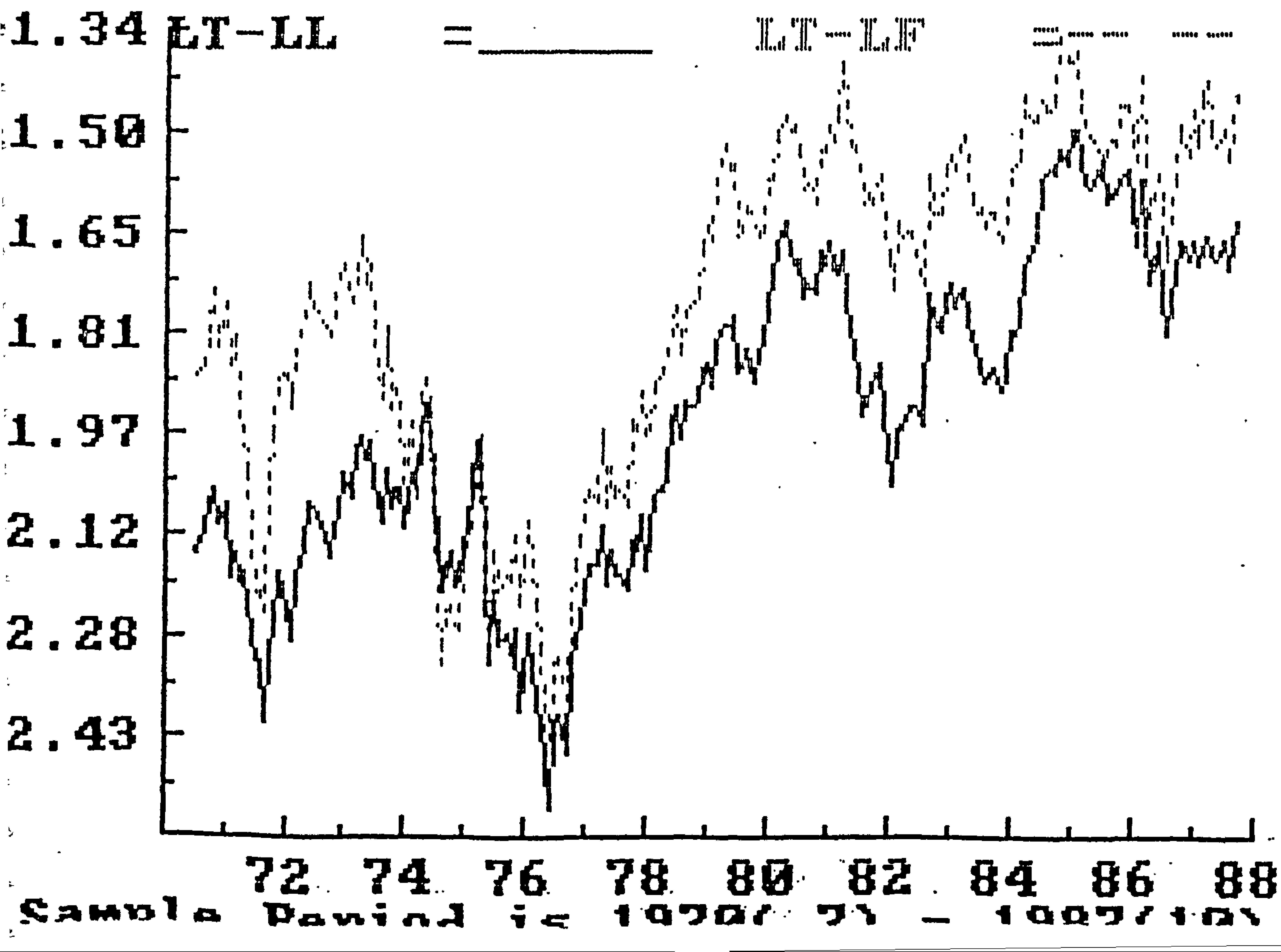
Sample Period is 1970(7) - 1987(10)

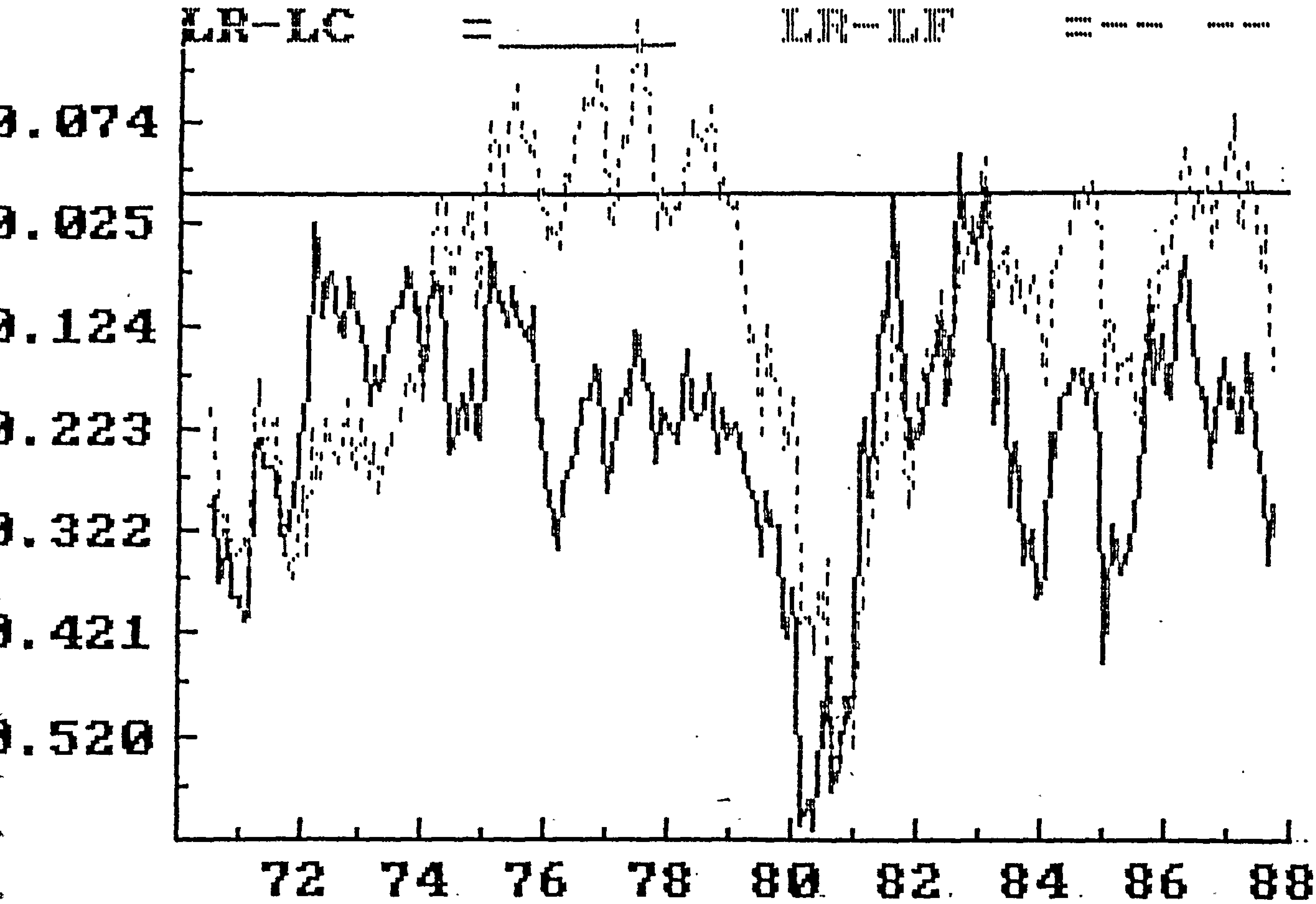


Sample Period is 1970(7) - 1987(10)

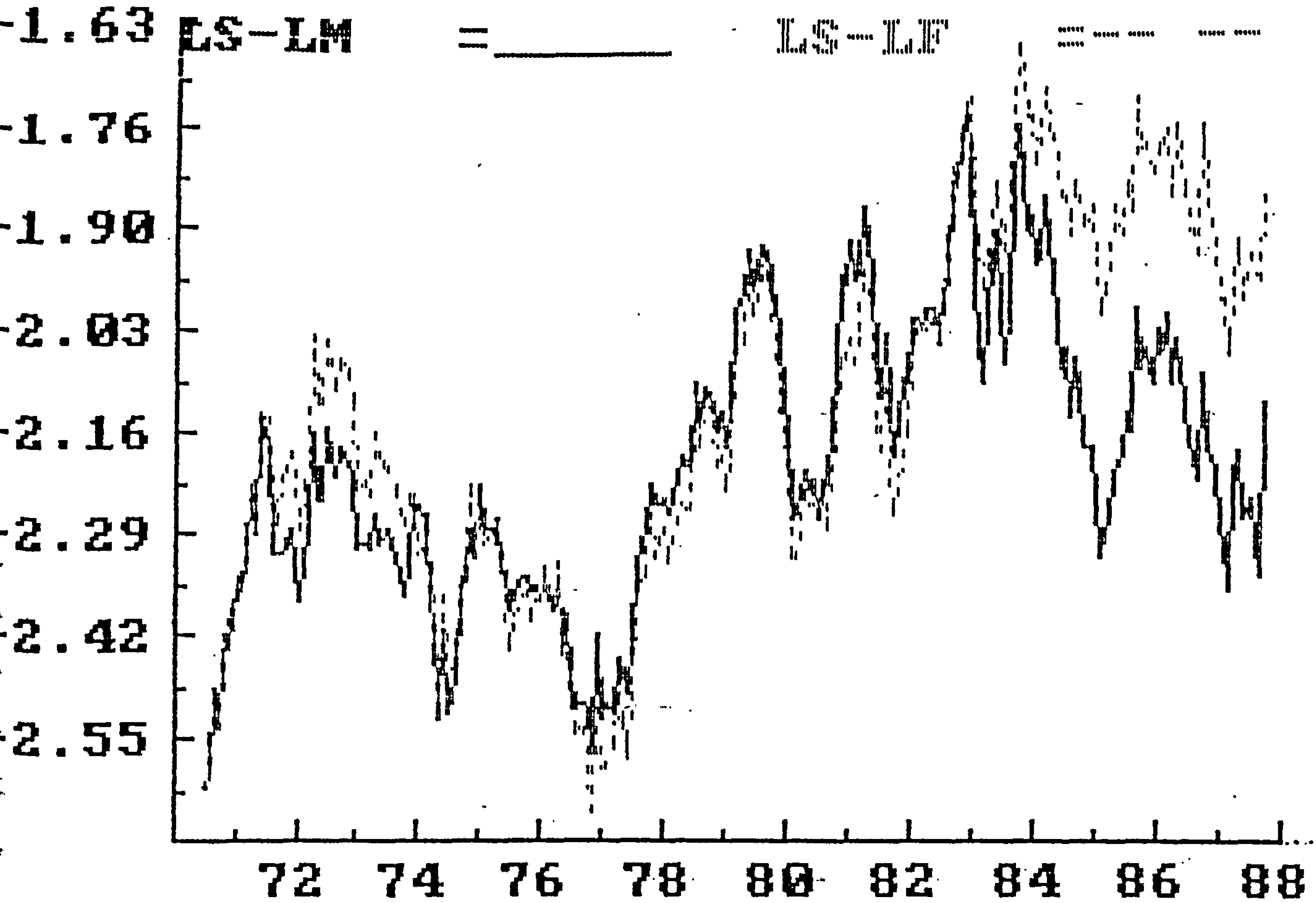



LLA-LL =
LLA-LF
-1.06
-1.38
-1.70
-2.01
-2.33
-2.65
-2.97
72 74 76 78 80 82 84 86 88
Sample Period is 1970(7) - 1987(10)

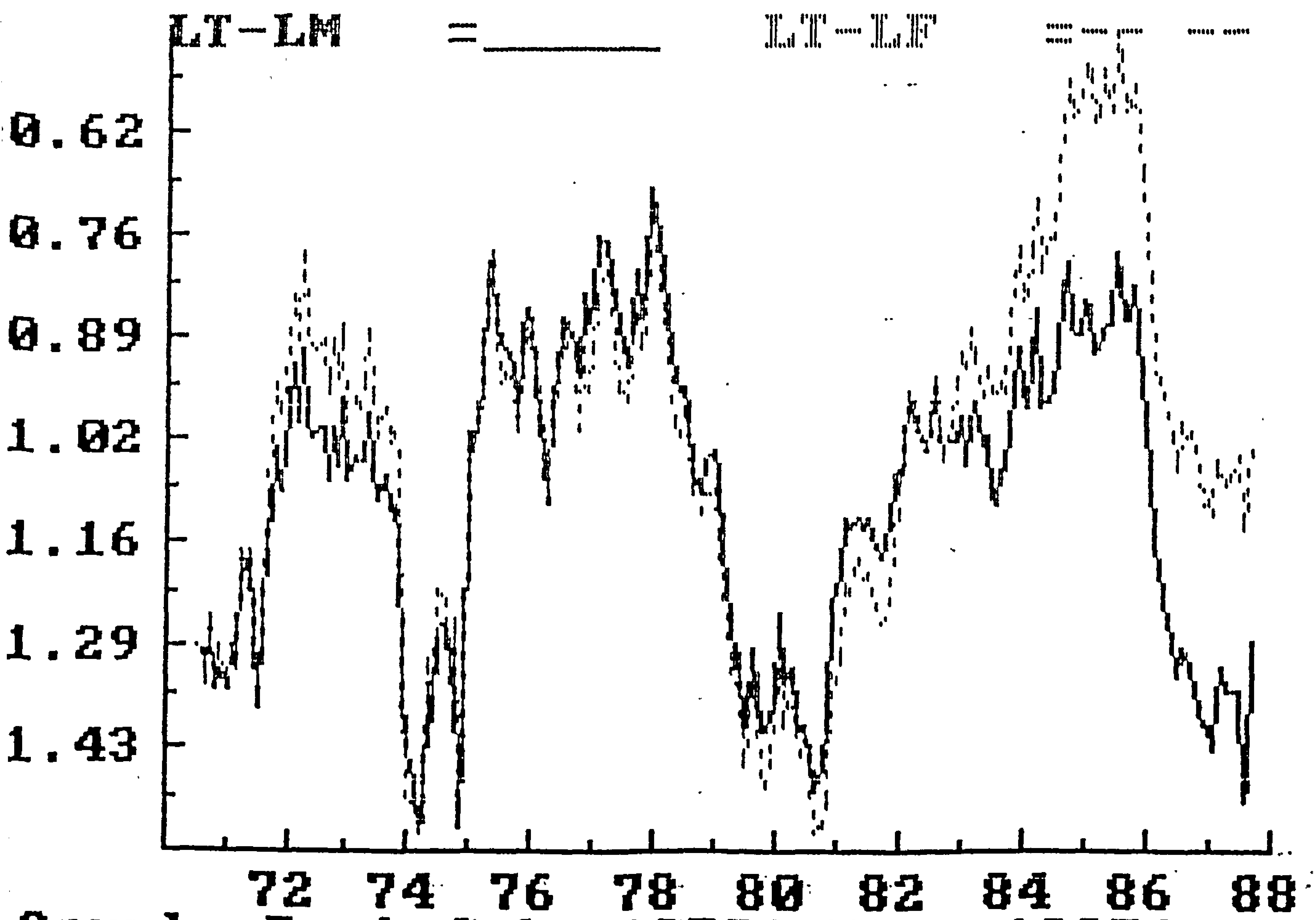

LT-LL =
LT-LF
-1.34
-1.50
-1.65
-1.81
-1.97
-2.12
-2.28
-2.43
72 74 76 78 80 82 84 86 88



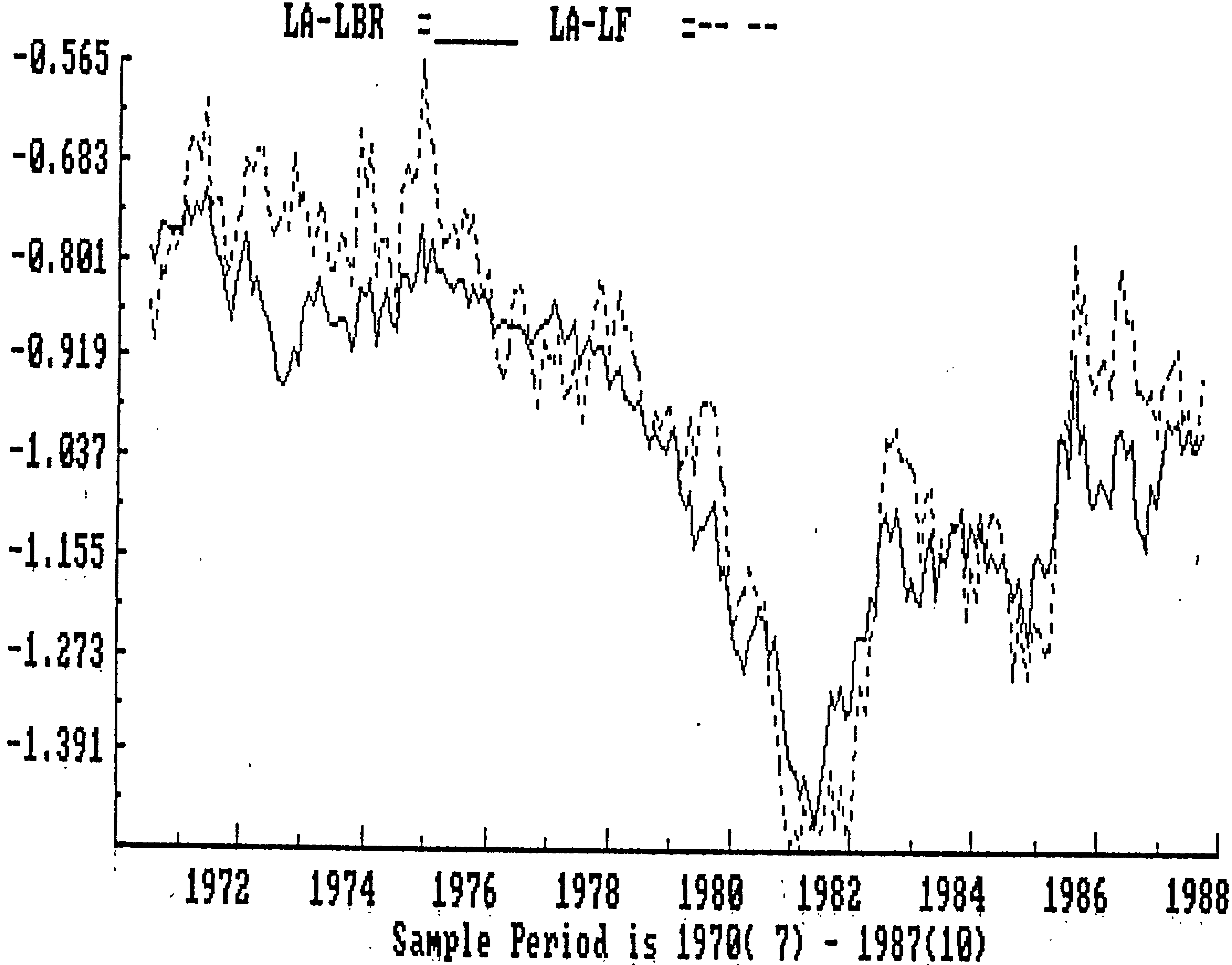
Sample Period is 1970(7) - 1987(10)

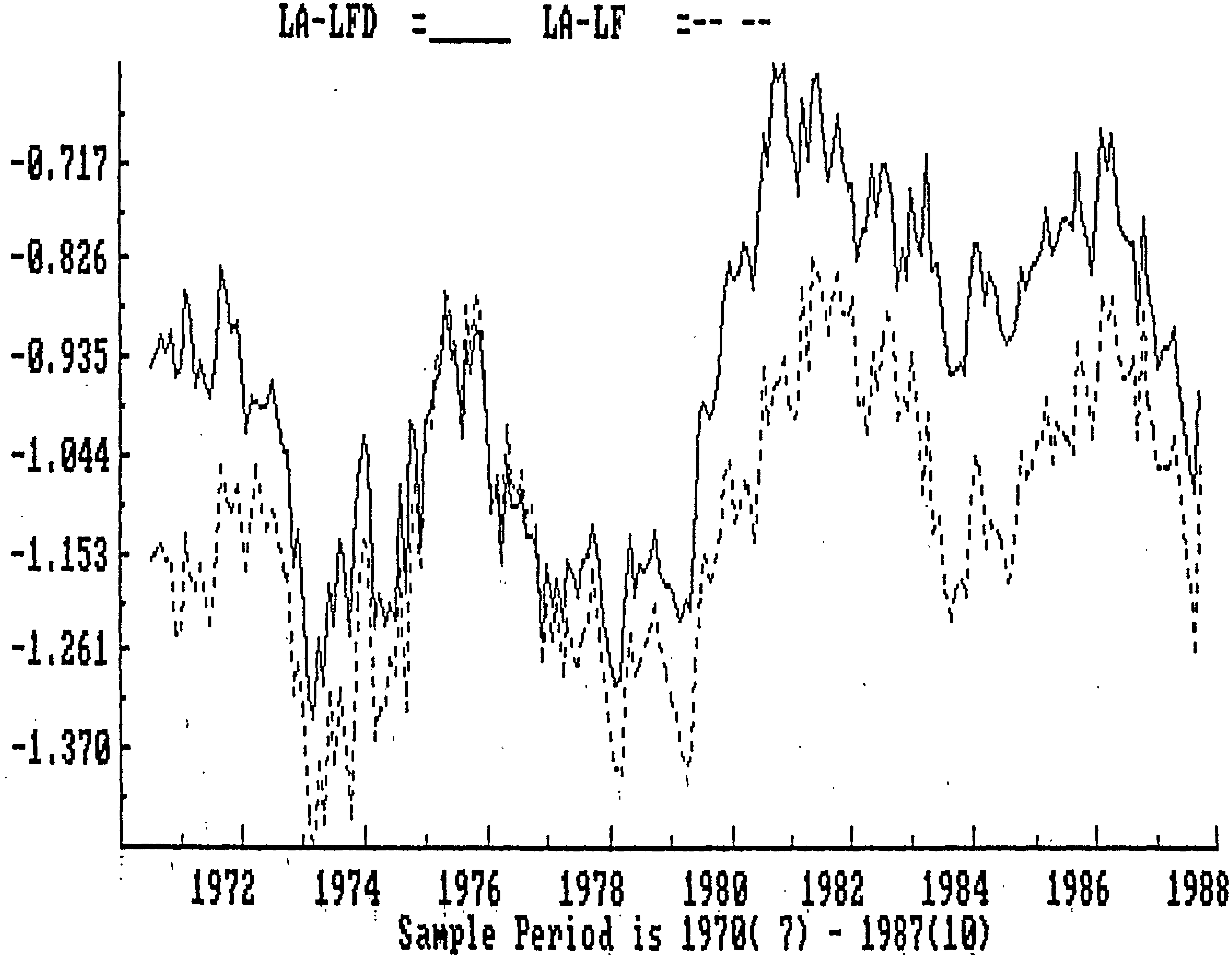


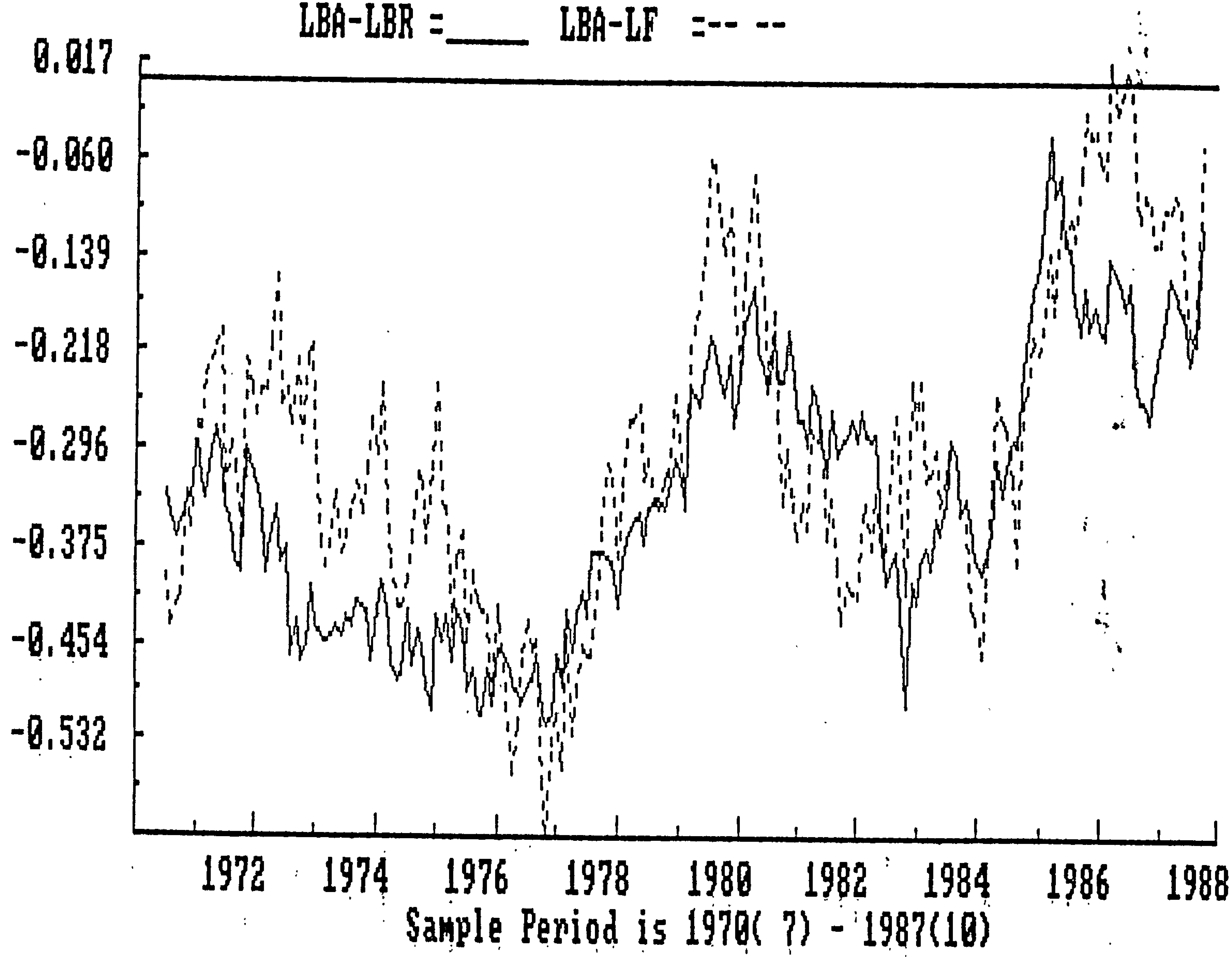
Sample Period is 1970(7) - 1987(10)



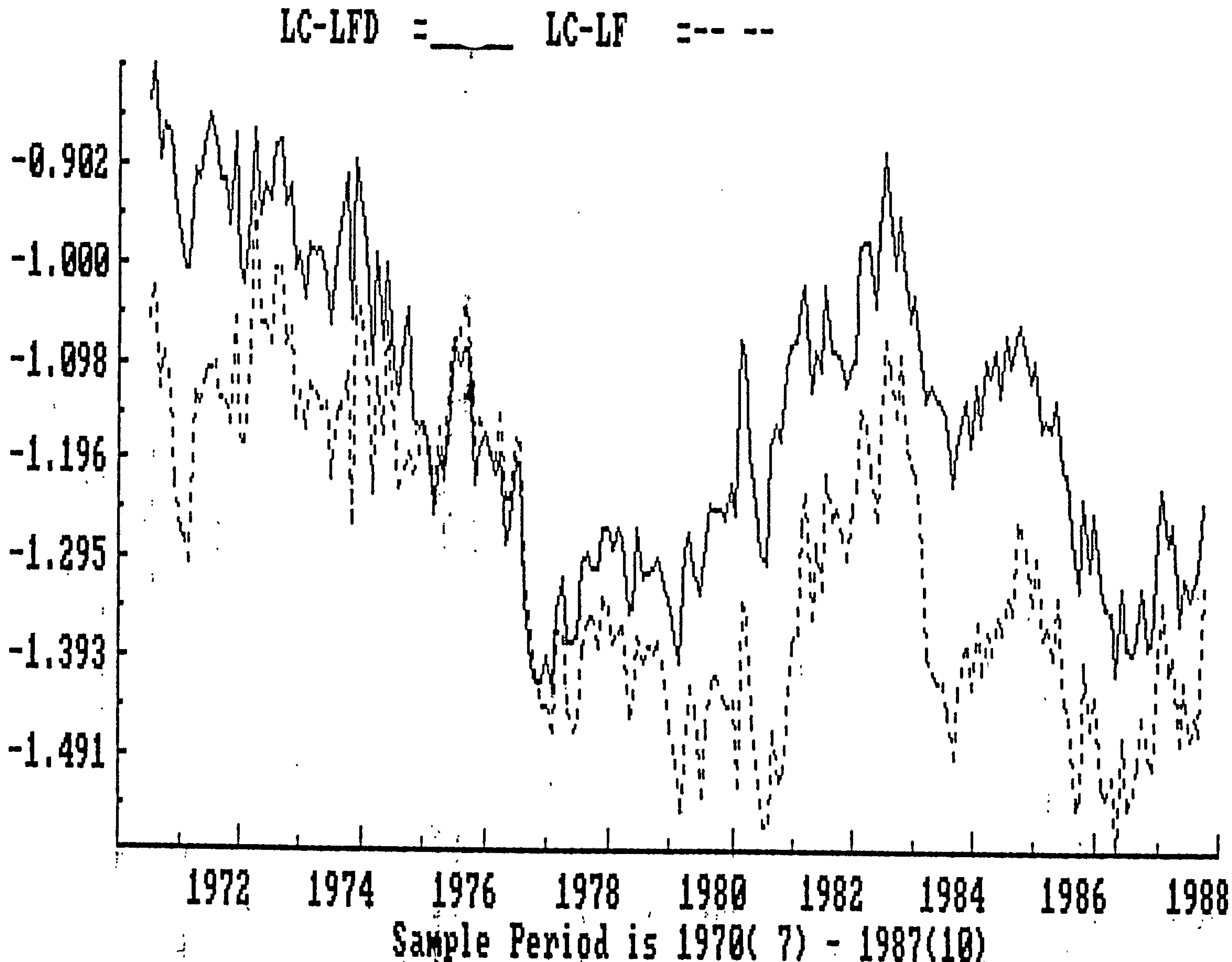
Sample Period is 1970(7) - 1987(10)

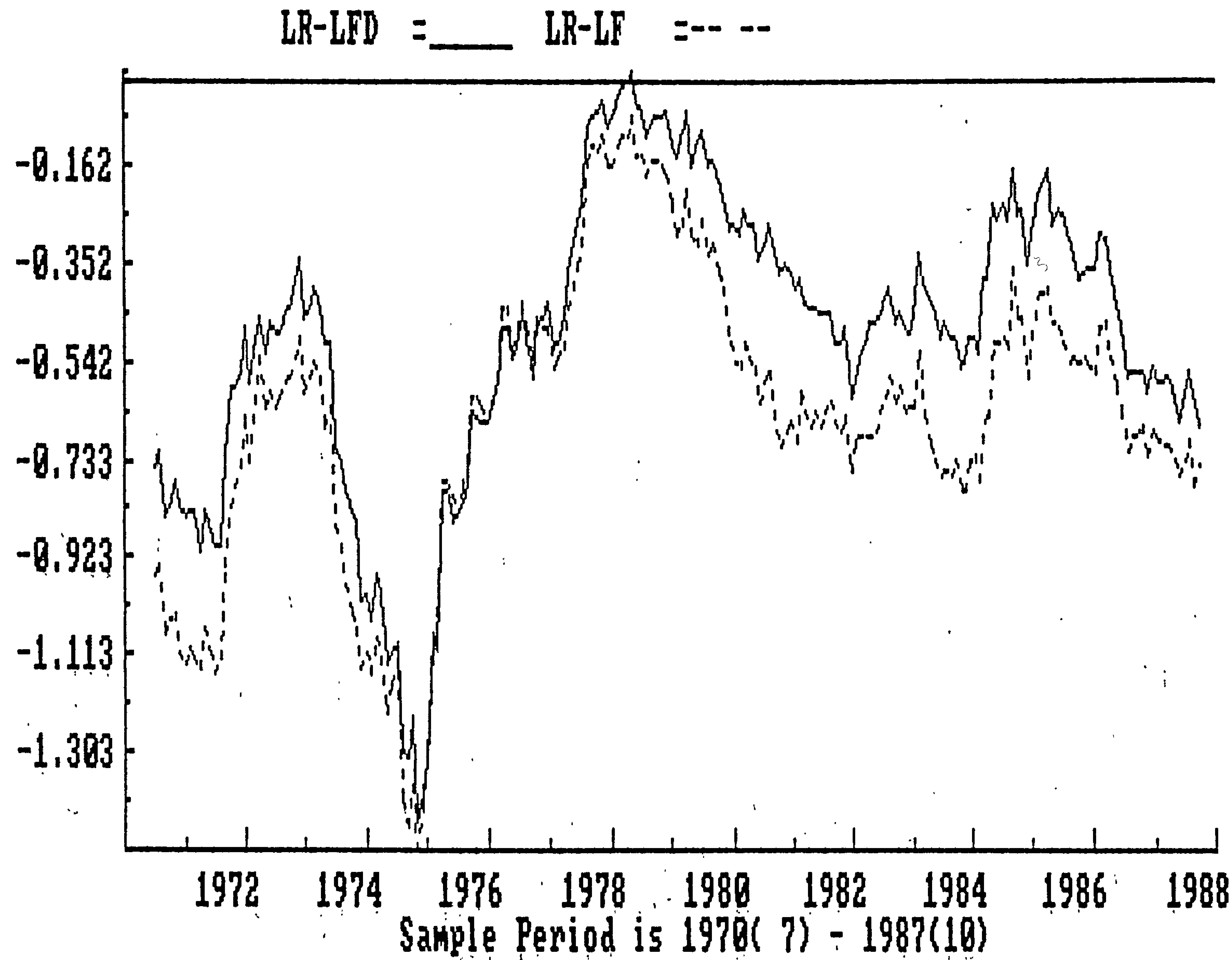

LA-LBR =____ LA-LF =-- --
-0.565
-0.683
-0.801
-0.919
-1.037
-1.155
-1.273
-1.391
1972
1974
1976
1978
1980
1982
1984
1986
1988
Sample Period is 1970(7) - 1987(10)

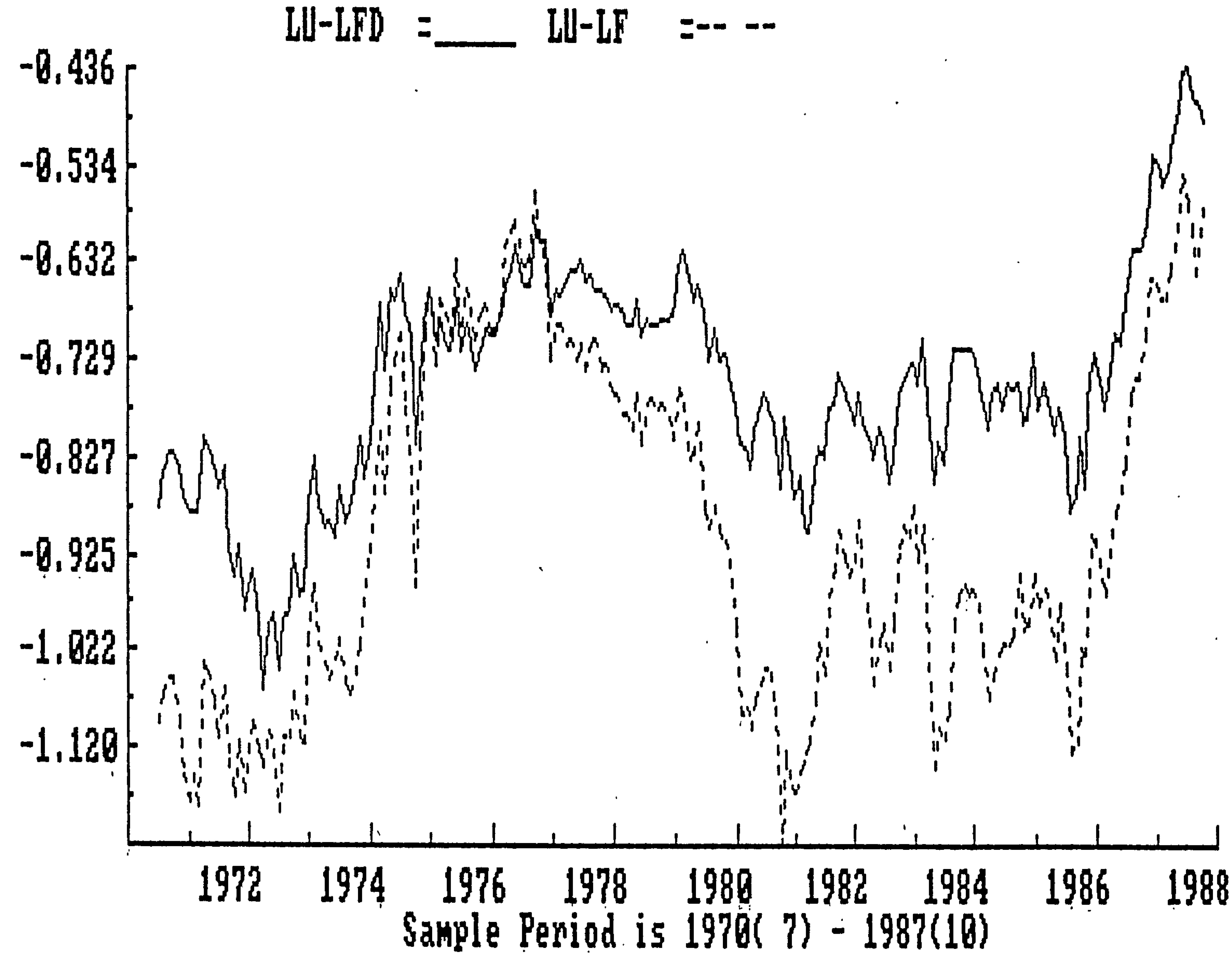

LA-LFD =____ LA-LF =-- --
-0.717
-0.826
-0.935
-1.044
-1.153
-1.261
-1.370
1972
1974
1976
1978
1980
1982
1984
1986
1988
Sample Period is 1970(7) - 1987(10)

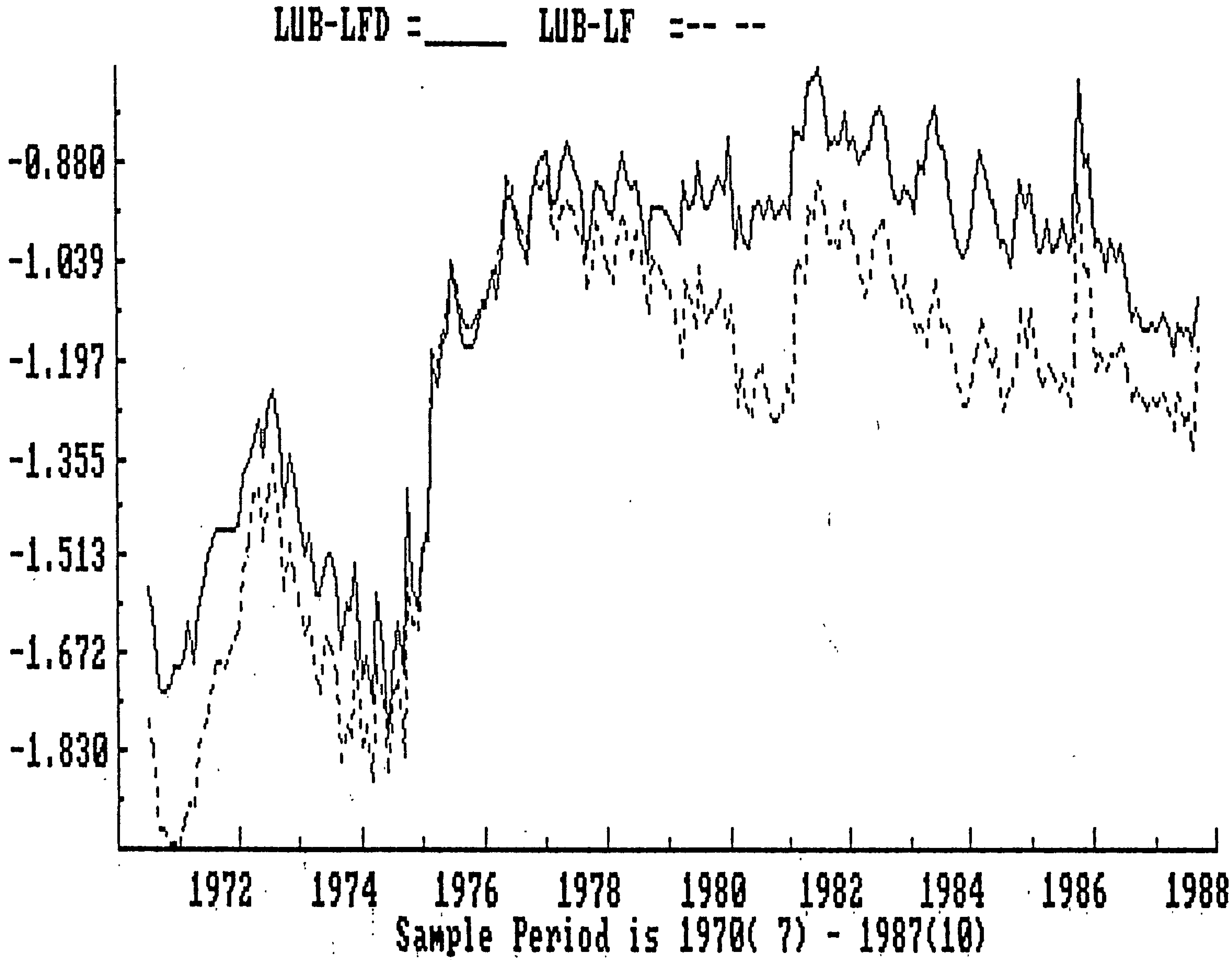


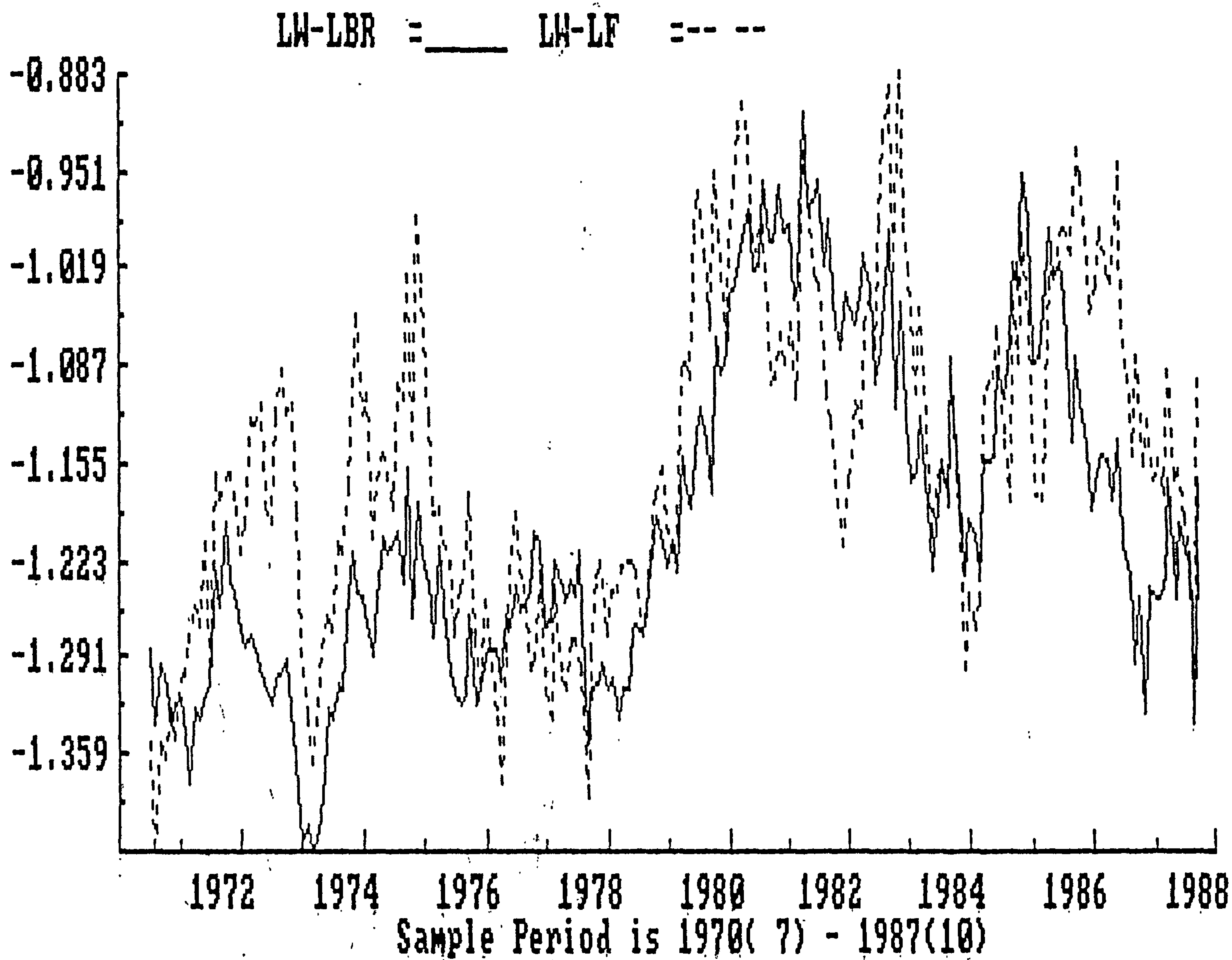
LBA-LBR =____ LBA-LF =-- --
0.017
-0.060
-0.139
-0.218
-0.296
-0.375
-0.454
-0.532
1972
1974
1976
1978
1980
1982
1984
1986
1988
Sample Period is 1970(7) - 1987(10)

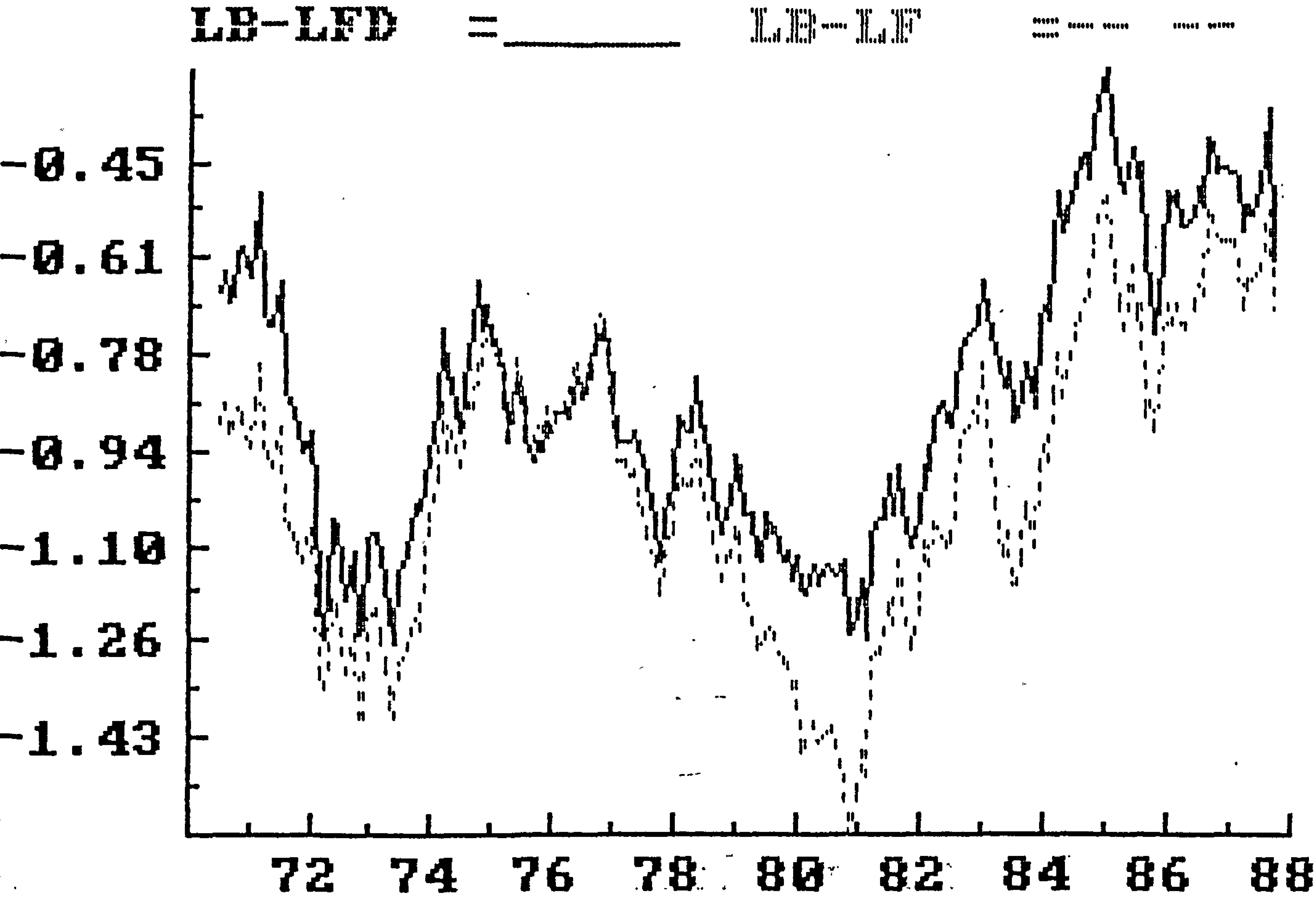

LC-LFD =
LC-LF =
-0.902
-1.000
-1.098
-1.196
-1.295
-1.393
-1.491
1972
1974
1976
1978
1980
1982
1984
1986
1988
Sample Period is 1970(7) - 1987(10)


LR-LFD =____ LR-LF =-- --
-0.162
-0.352
-0.542
-0.733
-0.923
-1.113
-1.303
1972
1974
1976
1978
1980
1982
1984
1986
1988
Sample Period is 1970(7) - 1987(10)

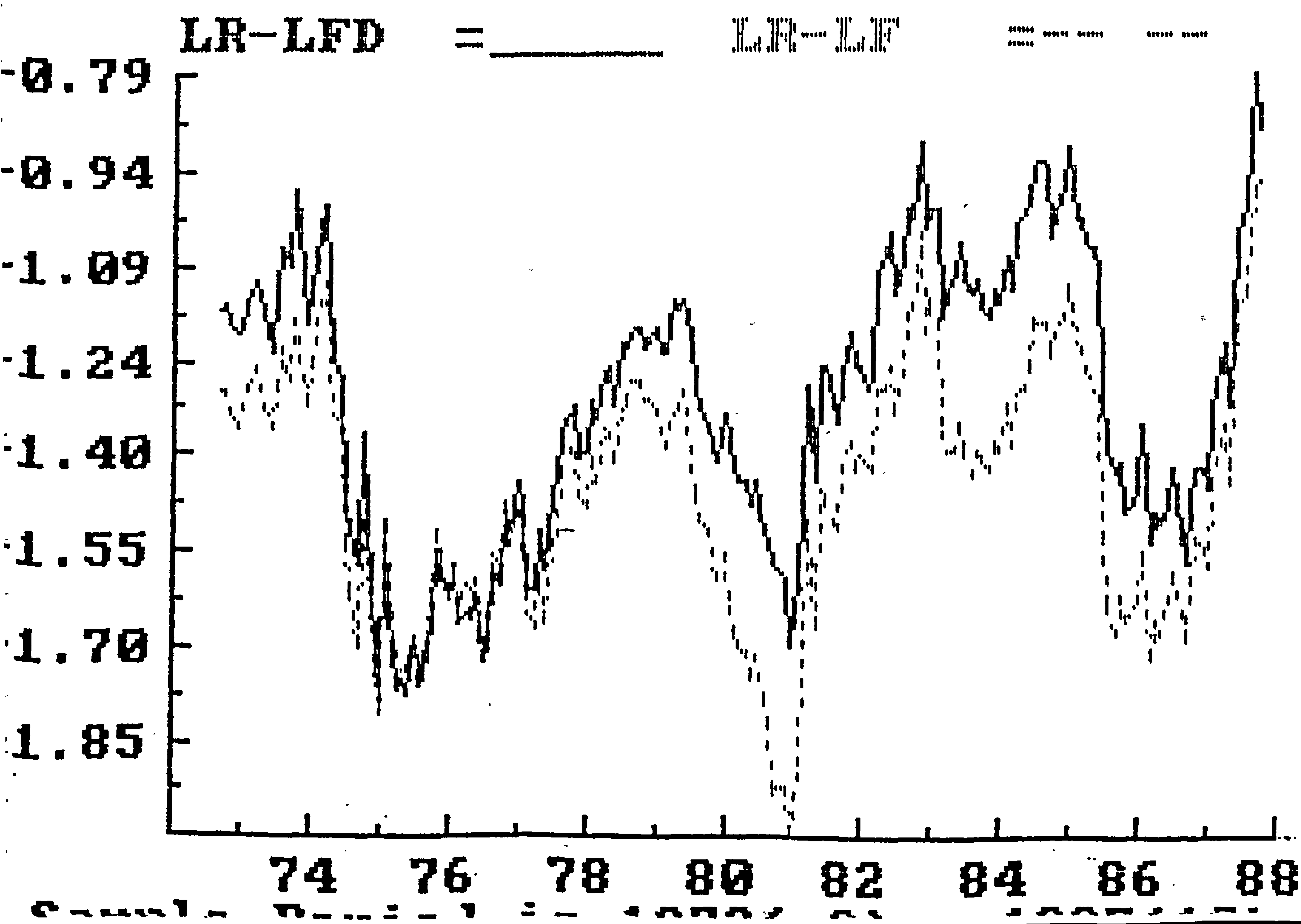

LU-LFD =____ LU-LF =-- --
-0.436
-0.534
-0.632
-0.729
-0.827
-0.925
-1.022
-1.120
1972
1974
1976
1978
1980
1982
1984
1986
1988
Sample Period is 1970(7) - 1987(10)

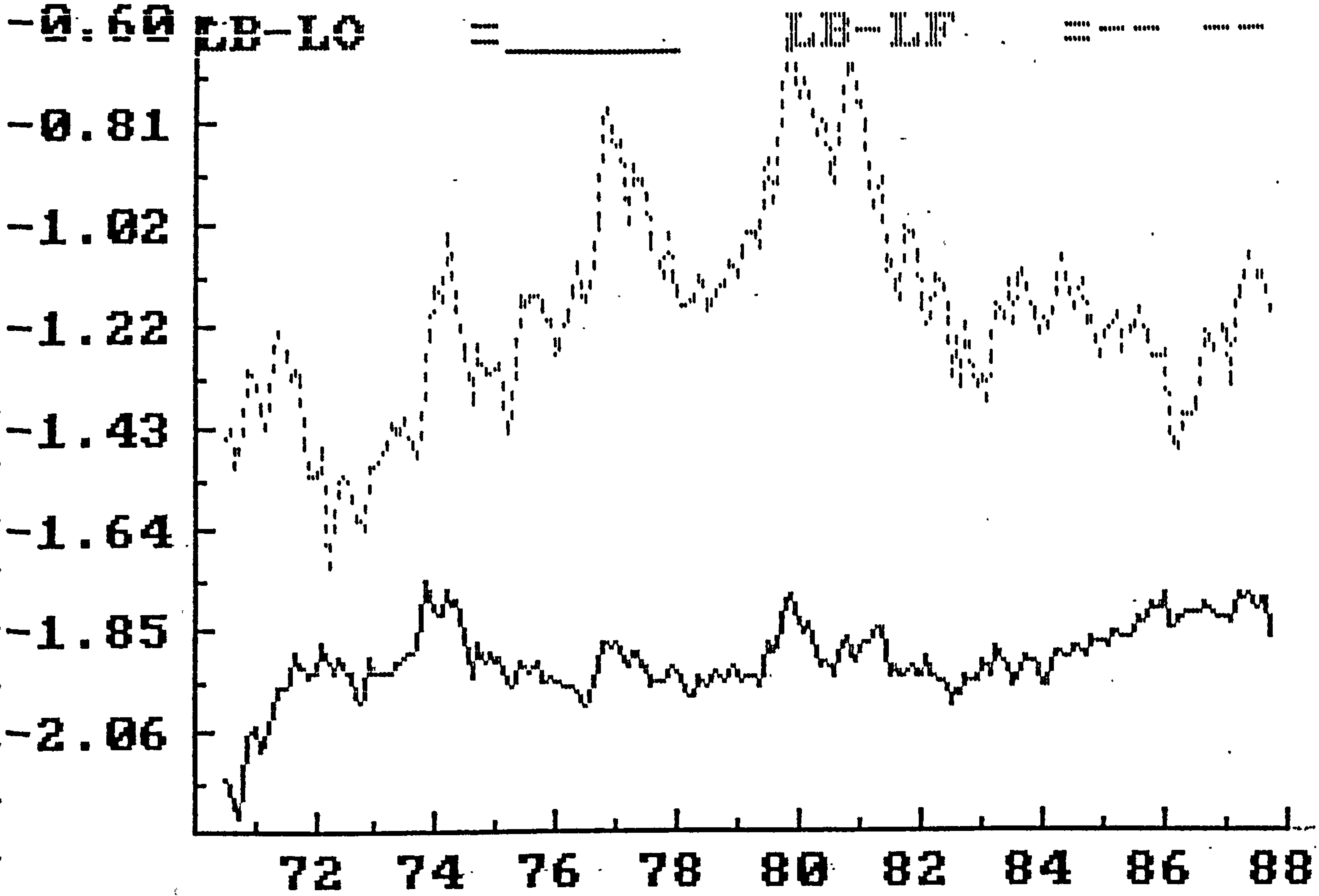

LUB-LFD =____ LUB-LF =-- --
-0.880
-1.039
-1.197
-1.355
-1.513
-1.672
-1.830
1972
1974
1976
1978
1980
1982
1984
1986
1988
Sample Period is 1970(7) - 1987(10)


LW-LBR =____ LW-LF =-- --
-0.883
-0.951
-1.019
-1.087
-1.155
-1.223
-1.291
-1.359
1972
1974
1976
1978
1980
1982
1984
1986
1988
Sample Period is 1970(7) - 1987(10)

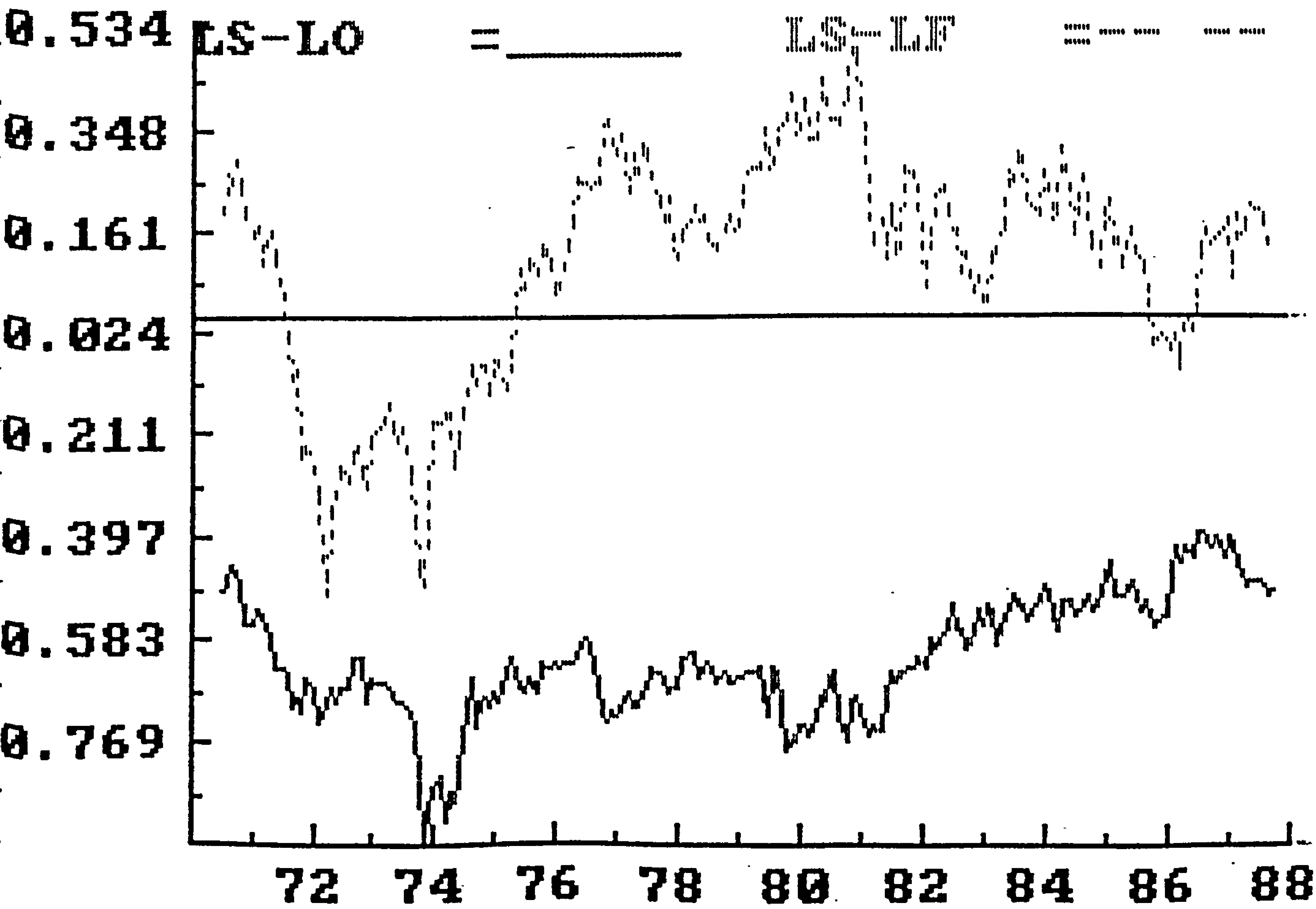


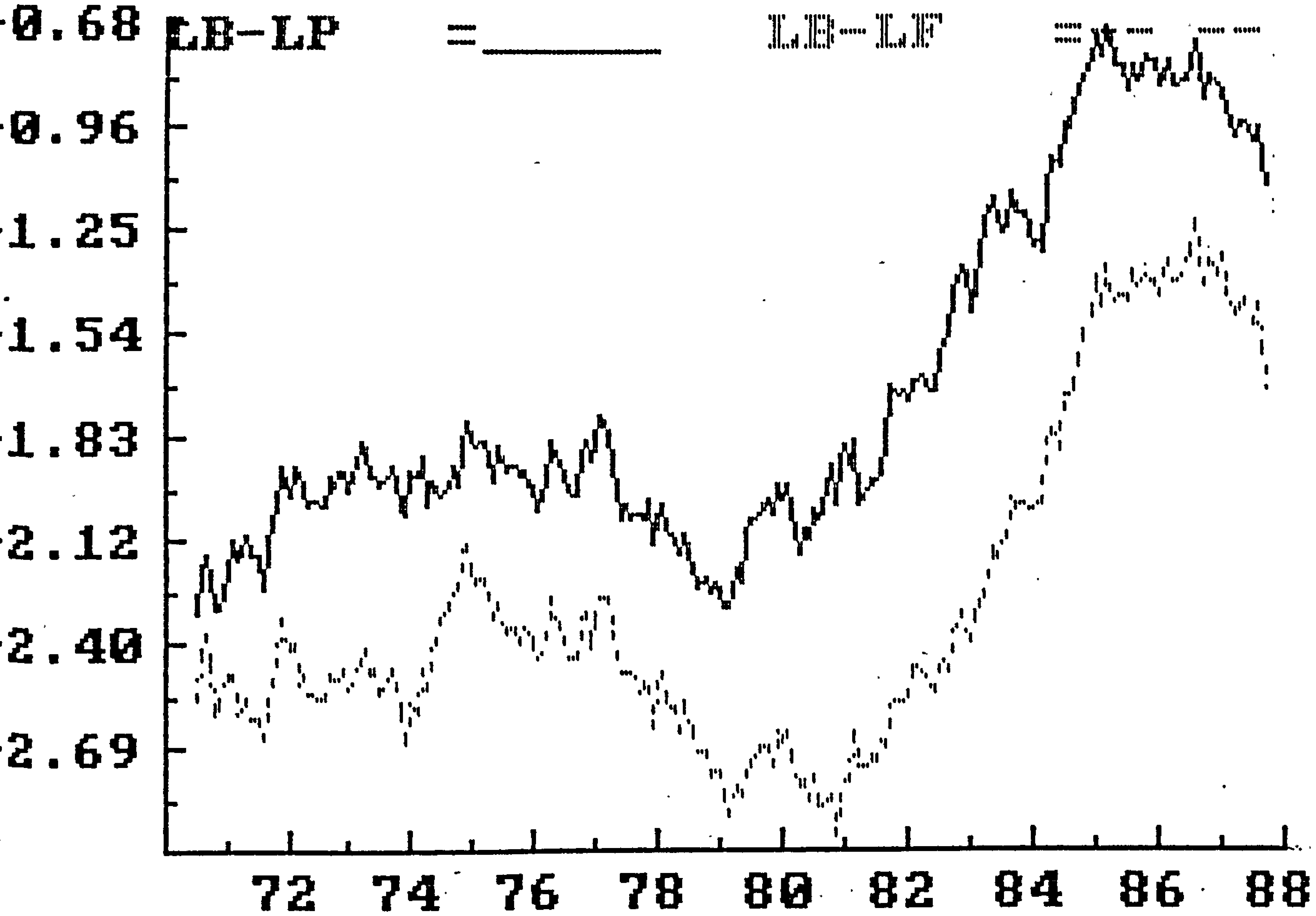
Sample Period is 1970(7) - 1987(10)



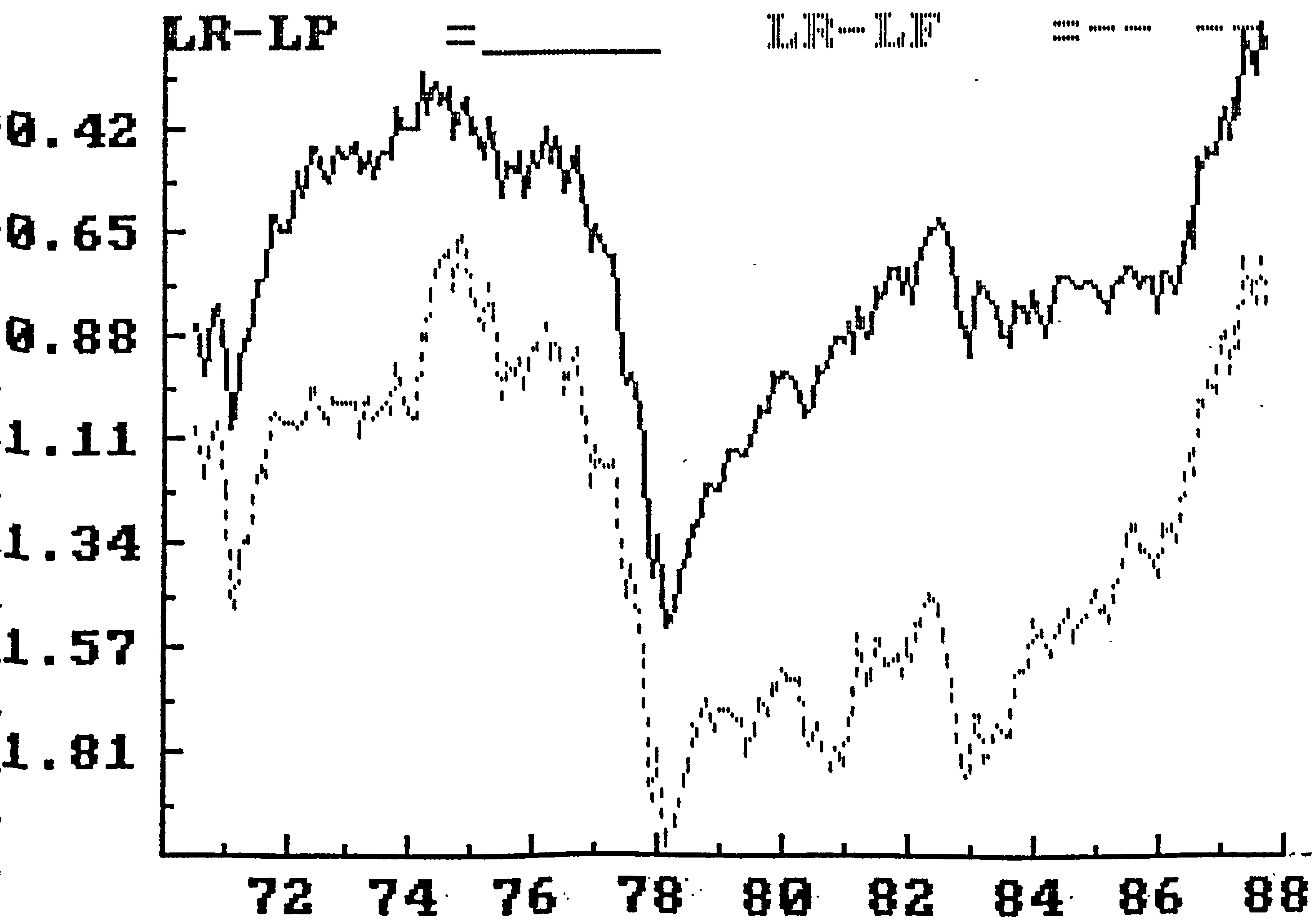


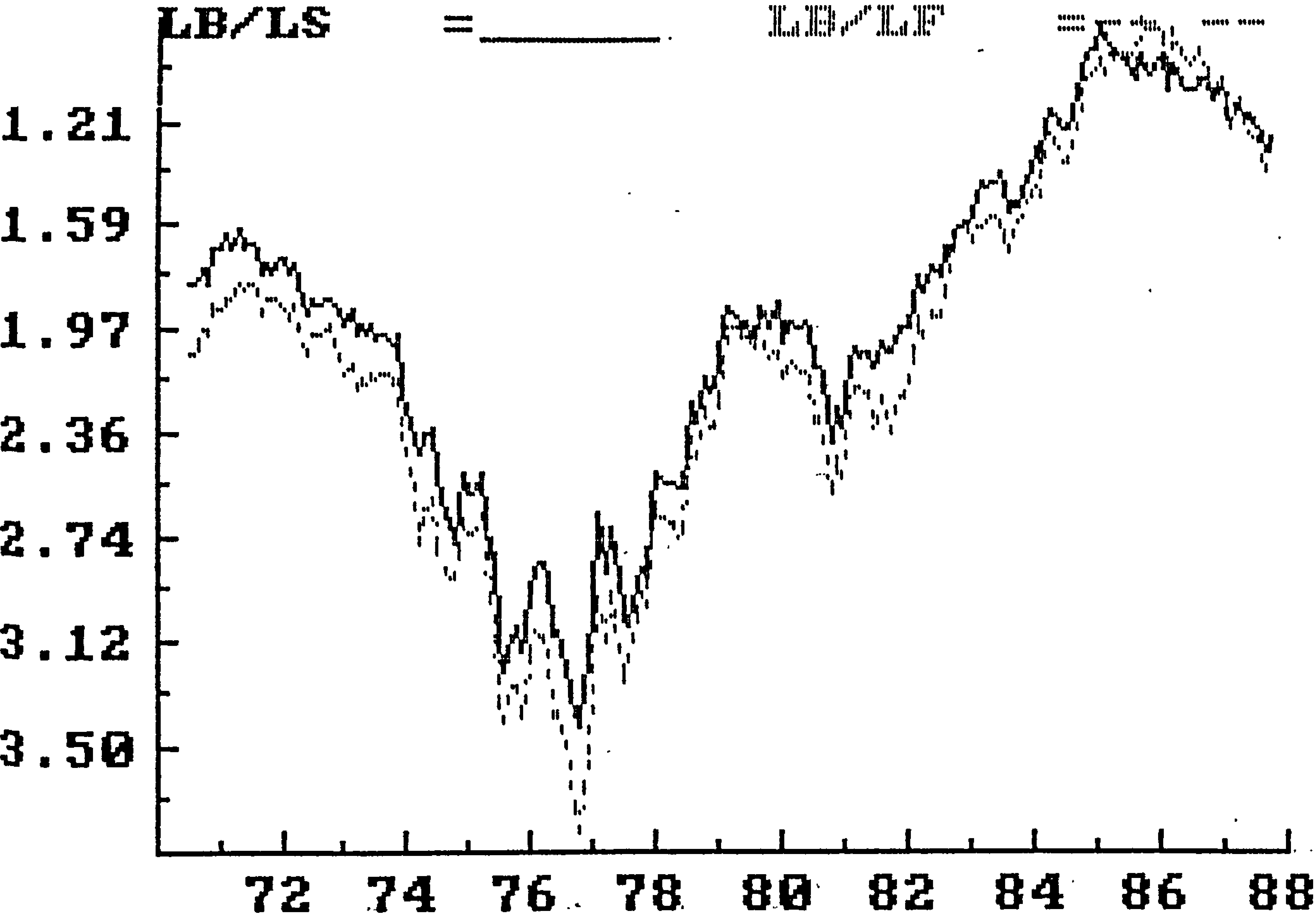
Sample Period is 1970(7) - 1987(10)



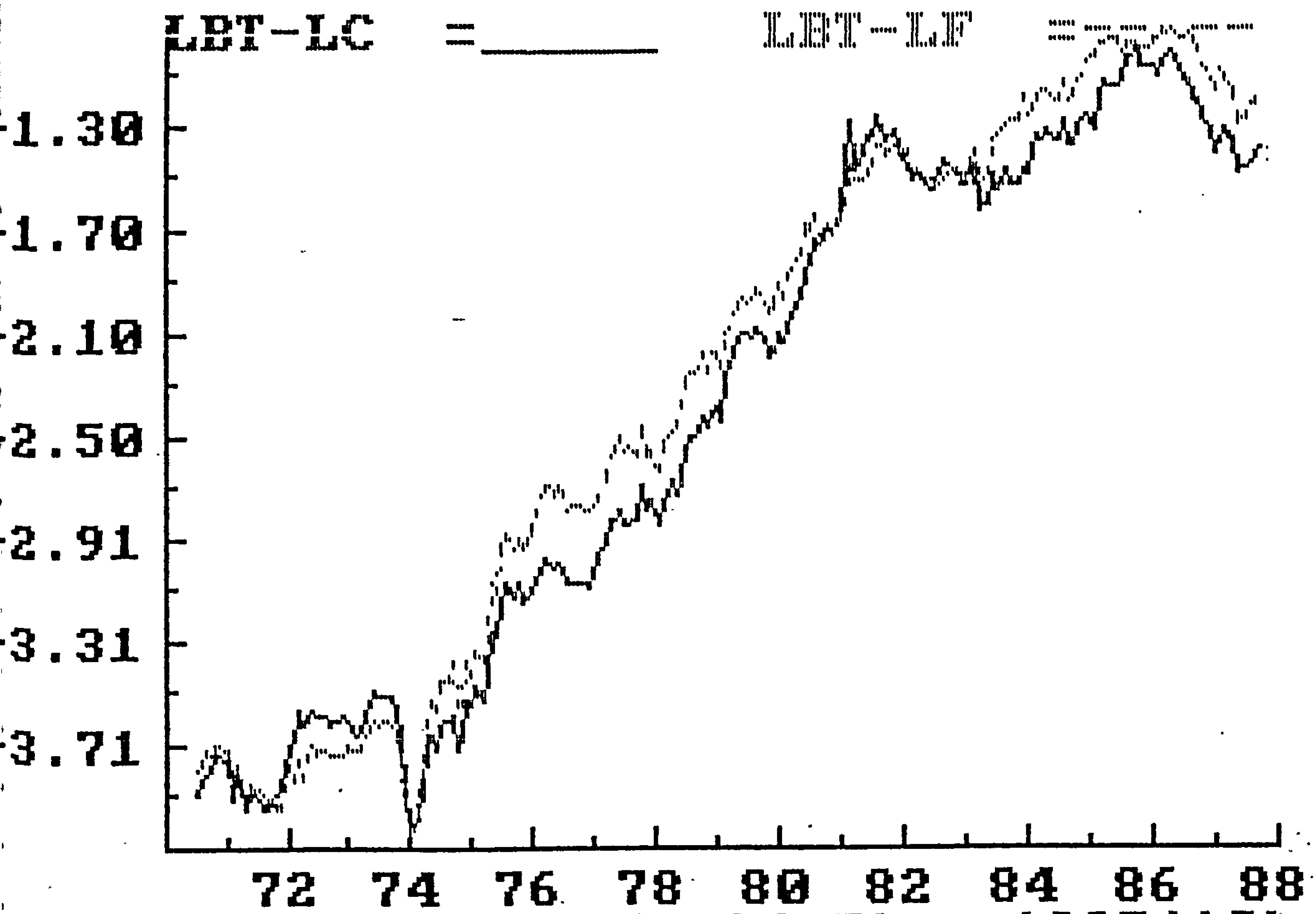


Sample Period is 1970(7) - 1987(10)

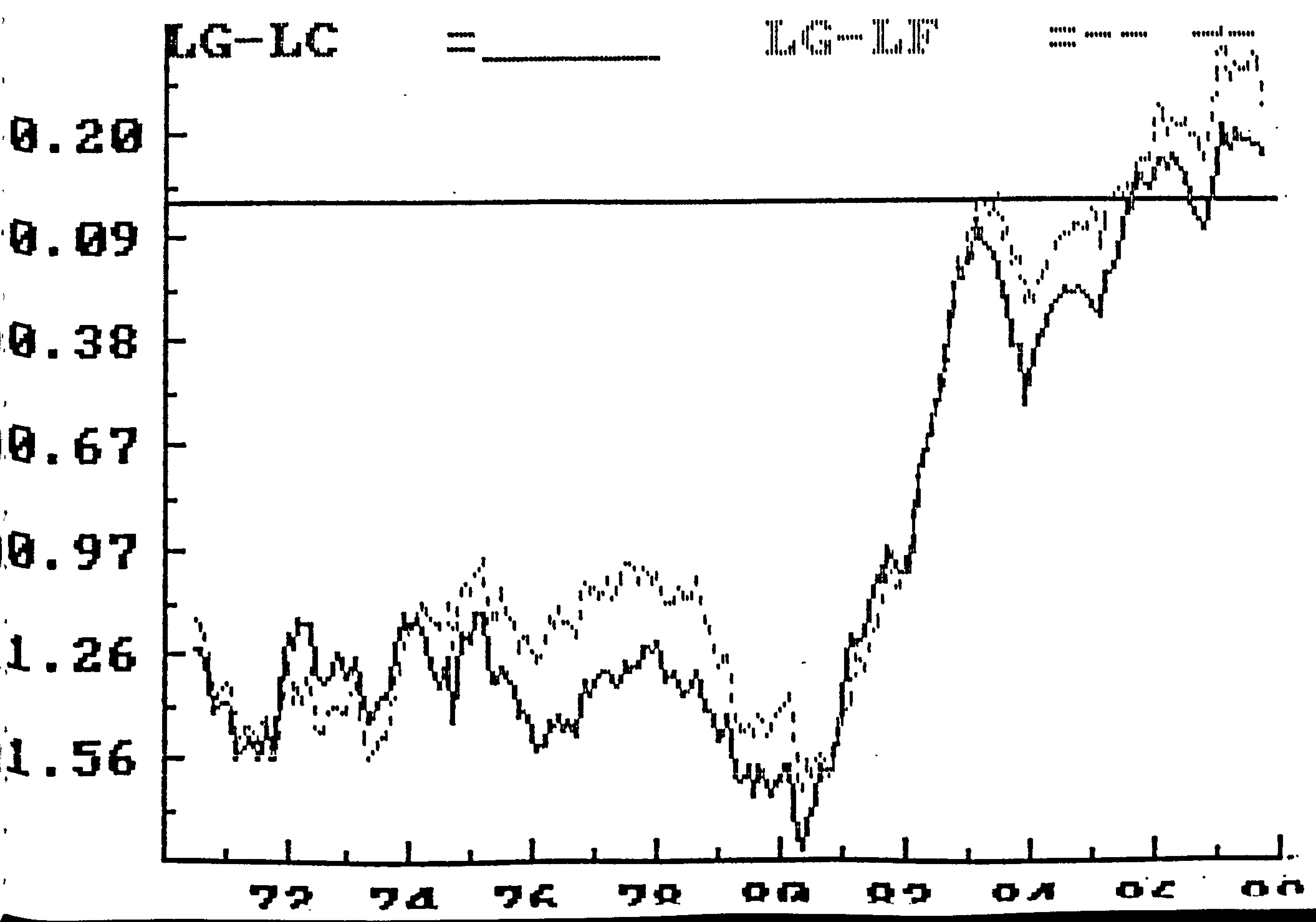


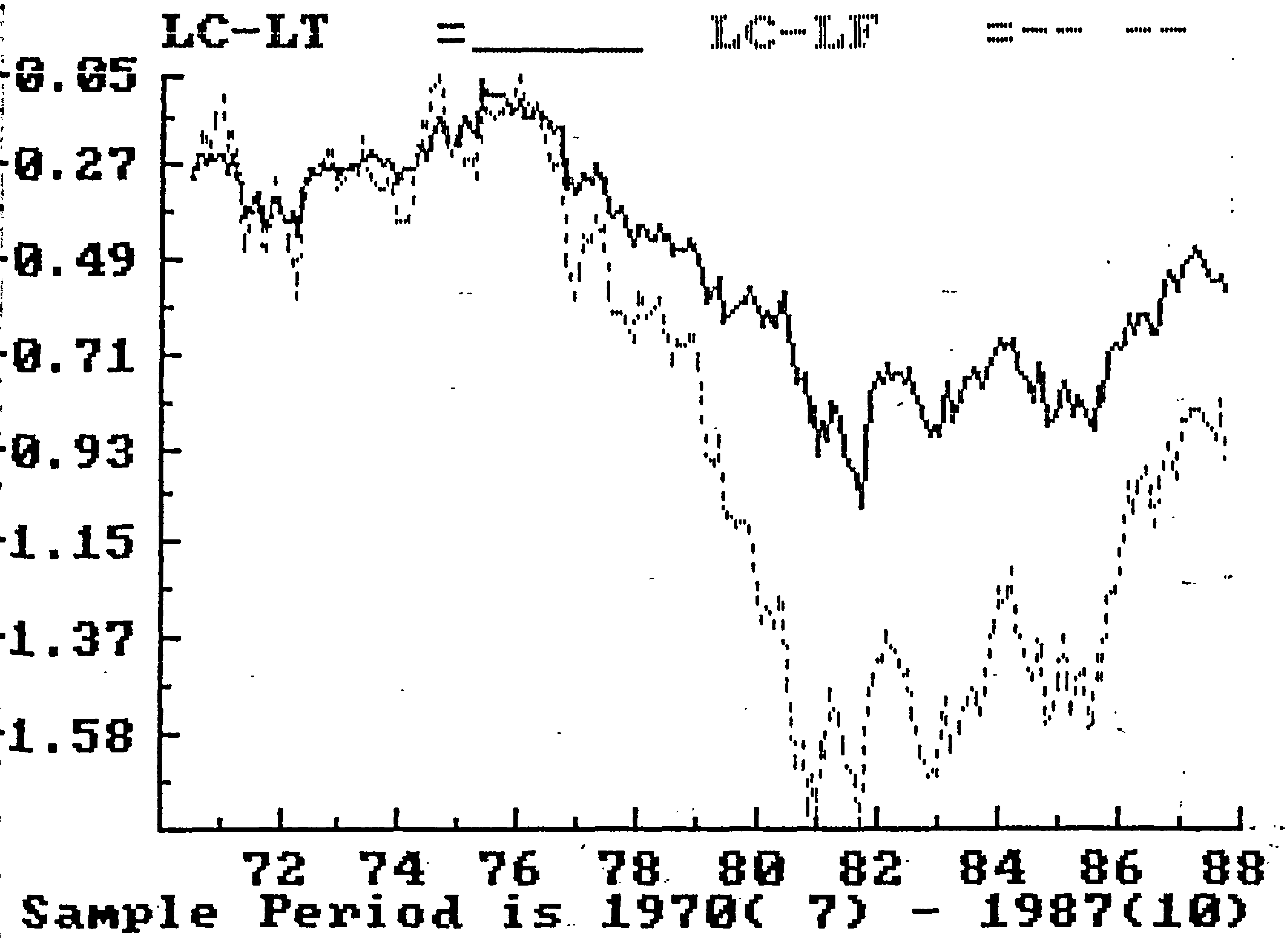


Sample Period is 1970(7) - 1987(10)

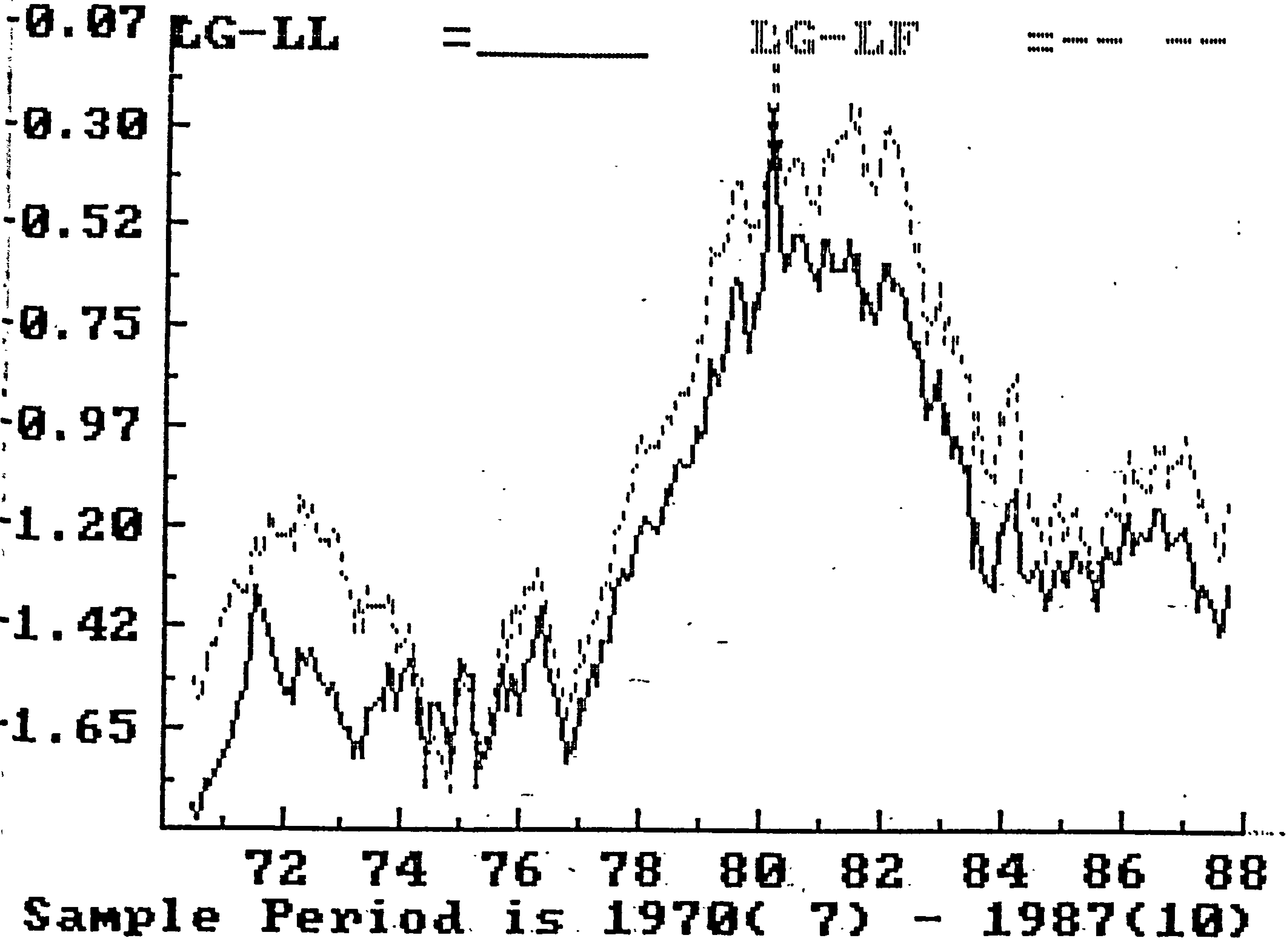


Sample Period is 1970(7) - 1987(10)

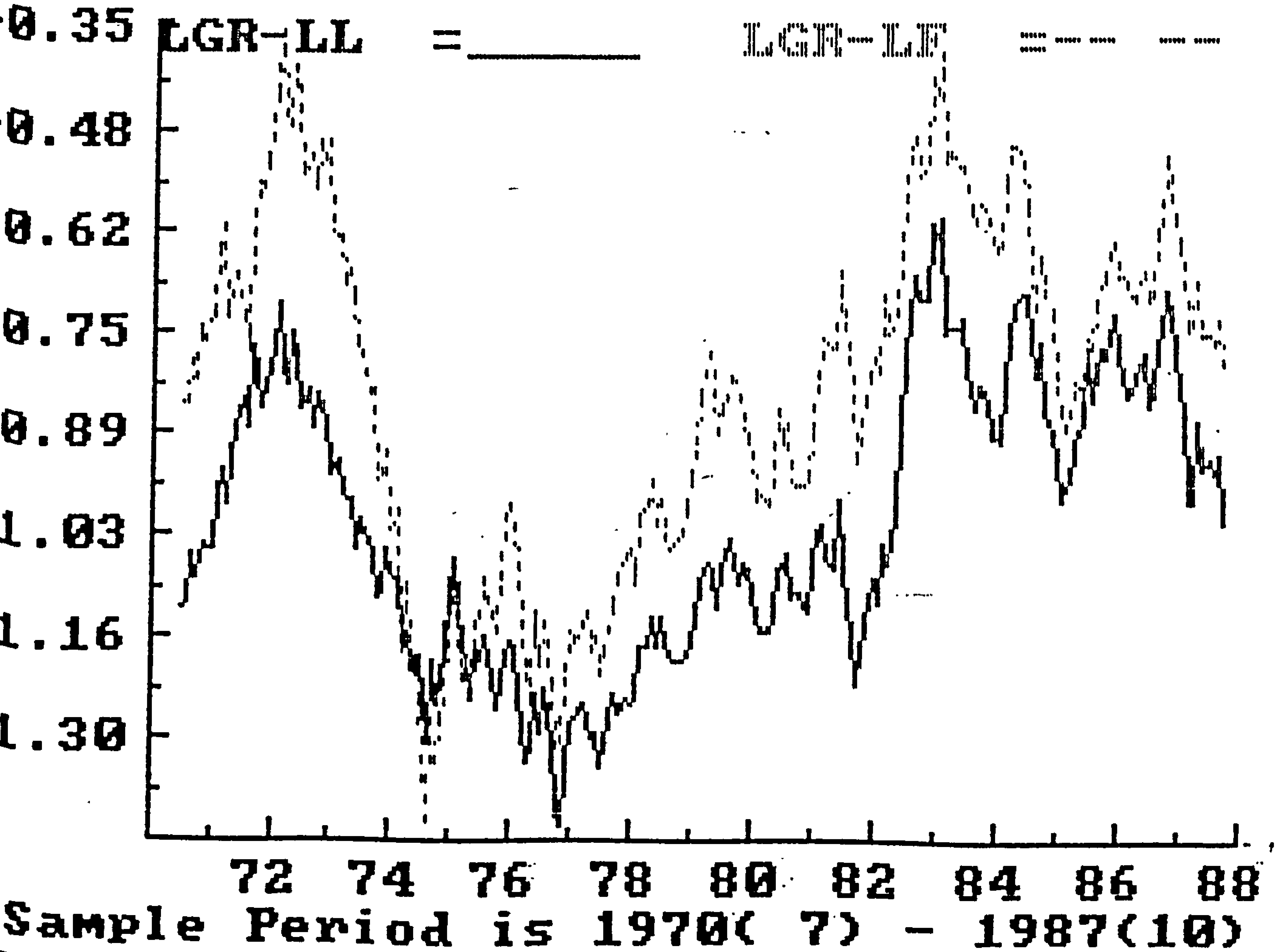




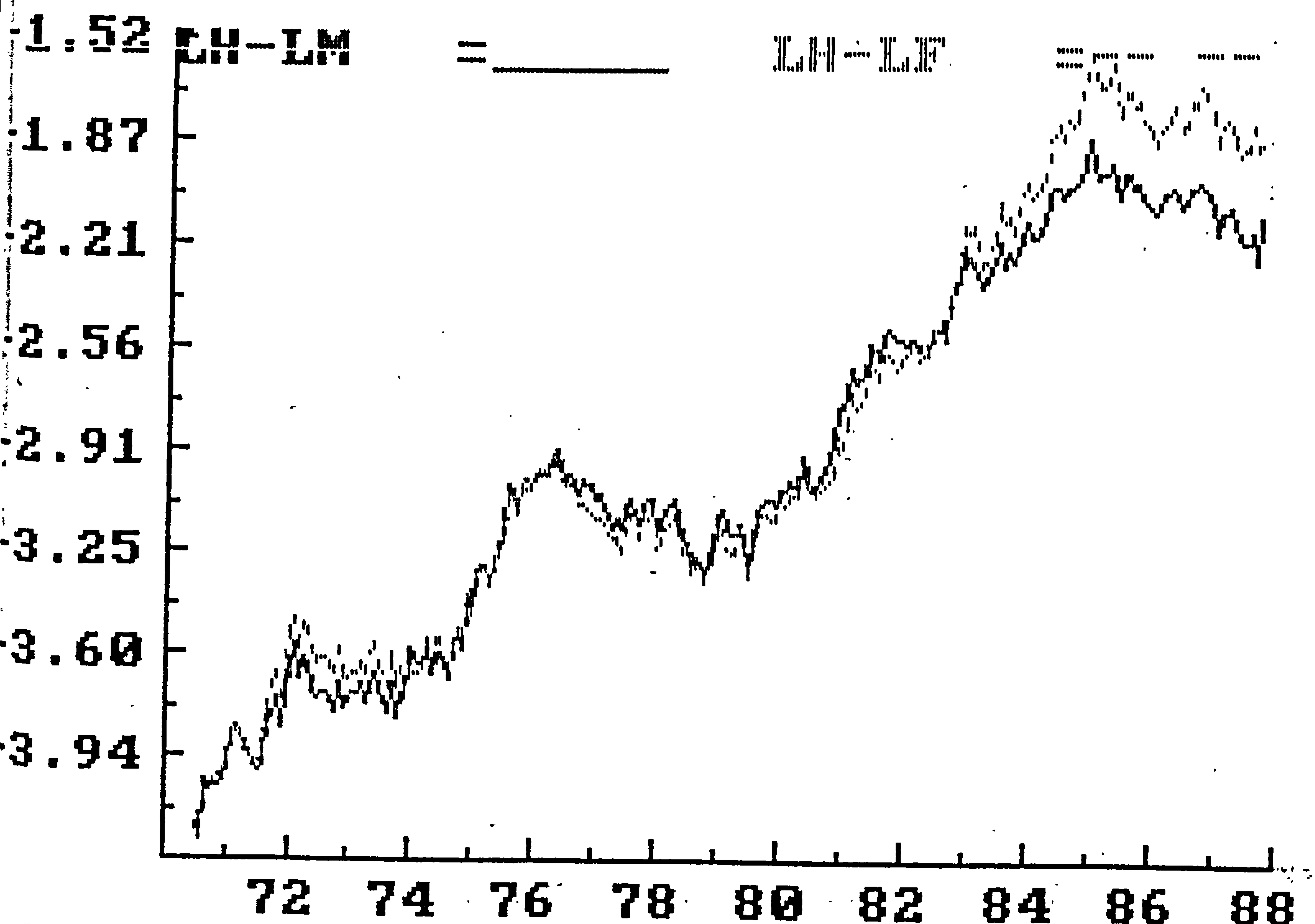
LC-LT =
LC-LF =
-0.05
-0.27
-0.49
-0.71
-0.93
-1.15
-1.37
-1.58
72
74
76
78
80
82
84
86
88
Sample Period is 1970(7) - 1987(10)



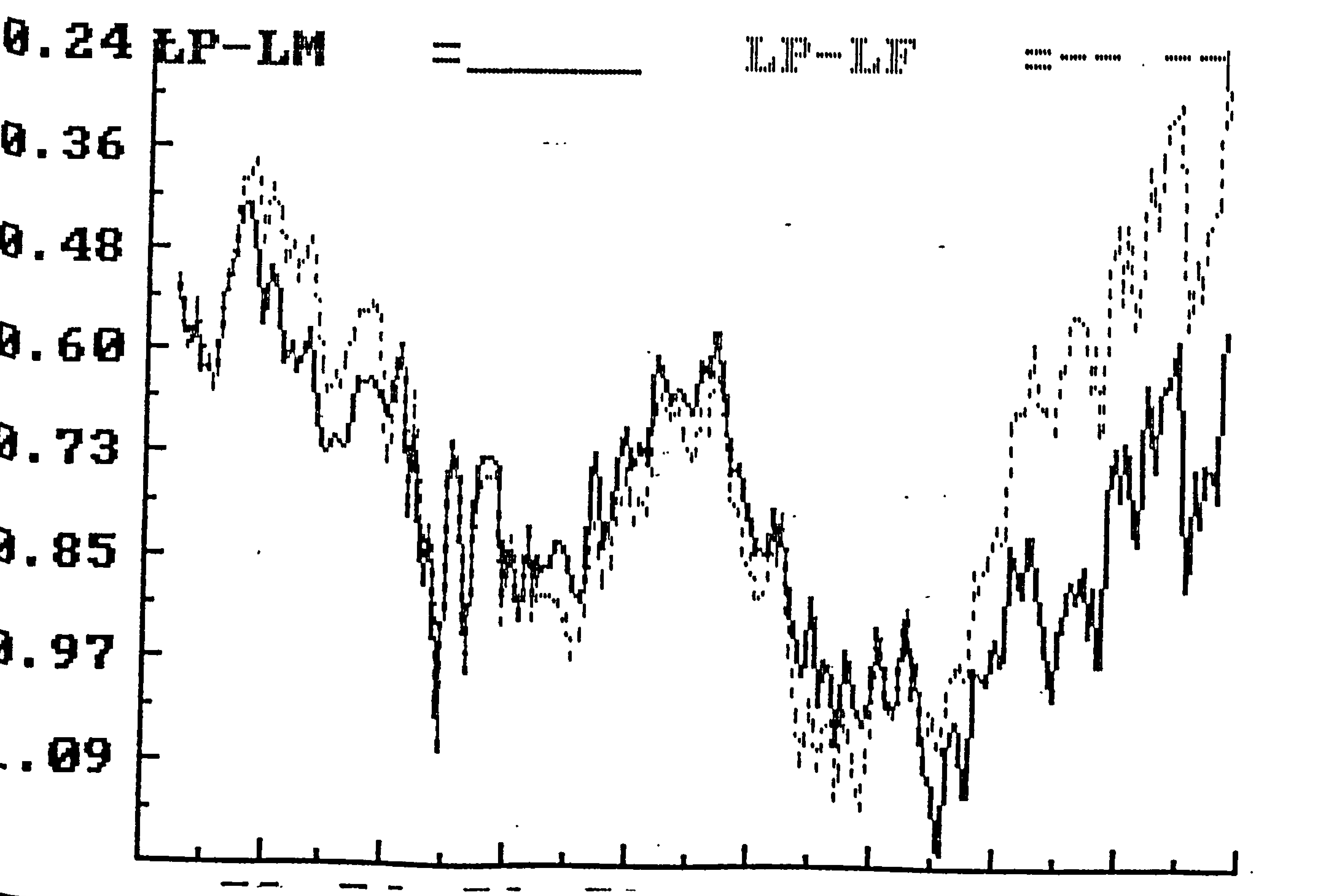
-0.07
-0.30
-0.52
-0.75
-0.97
-1.20
-1.42
-1.65
LG-LL =
LG-LF =
72 74 76 78 80 82 84 86 88
Sample Period is 1970(7) - 1987(10)

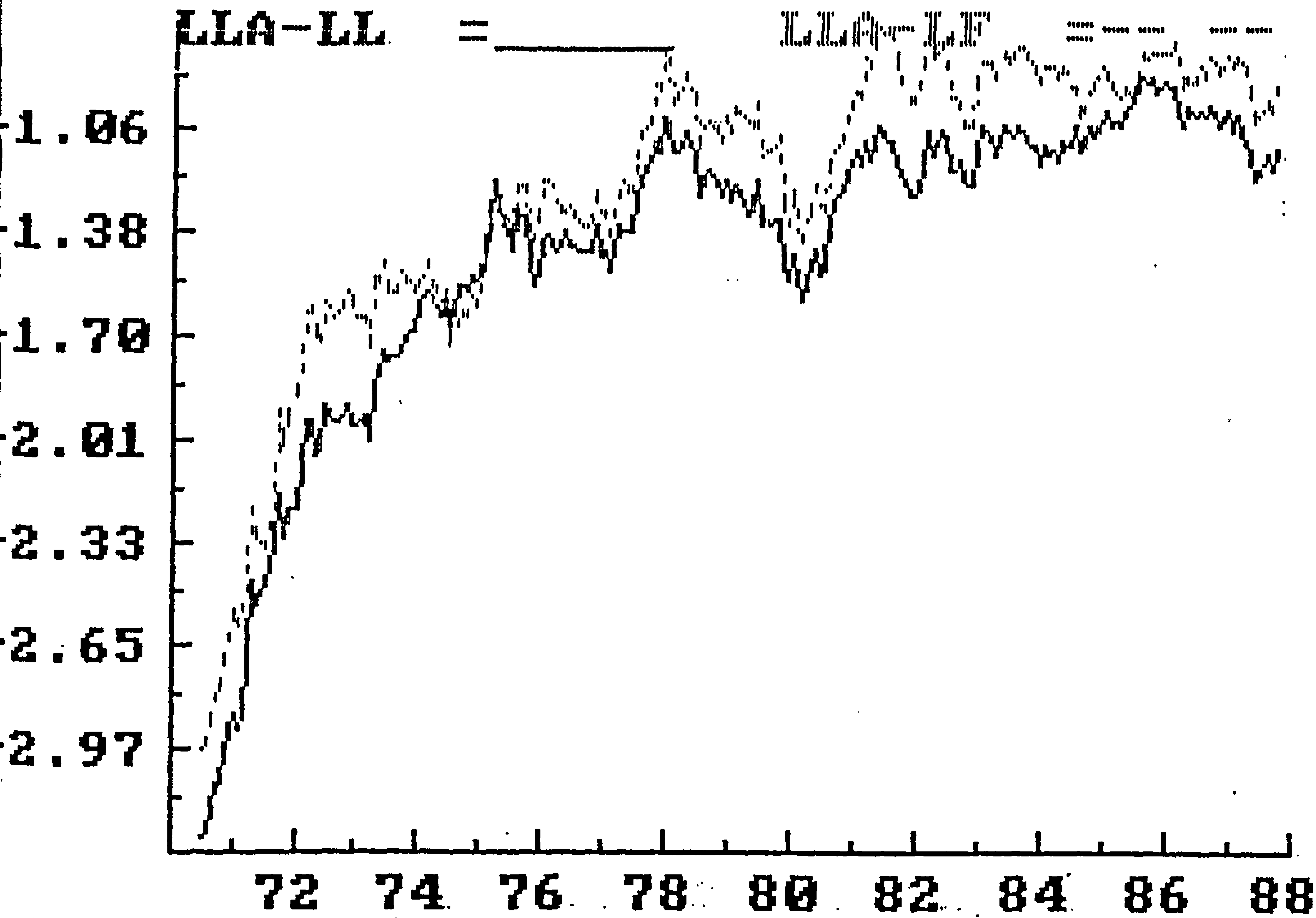


-0.35
-0.48
0.62
0.75
0.89
1.03
1.16
1.30
LGR-LL =
LGR-LF =
72 74 76 78 80 82 84 86 88
Sample Period is 1970(7) - 1987(10)

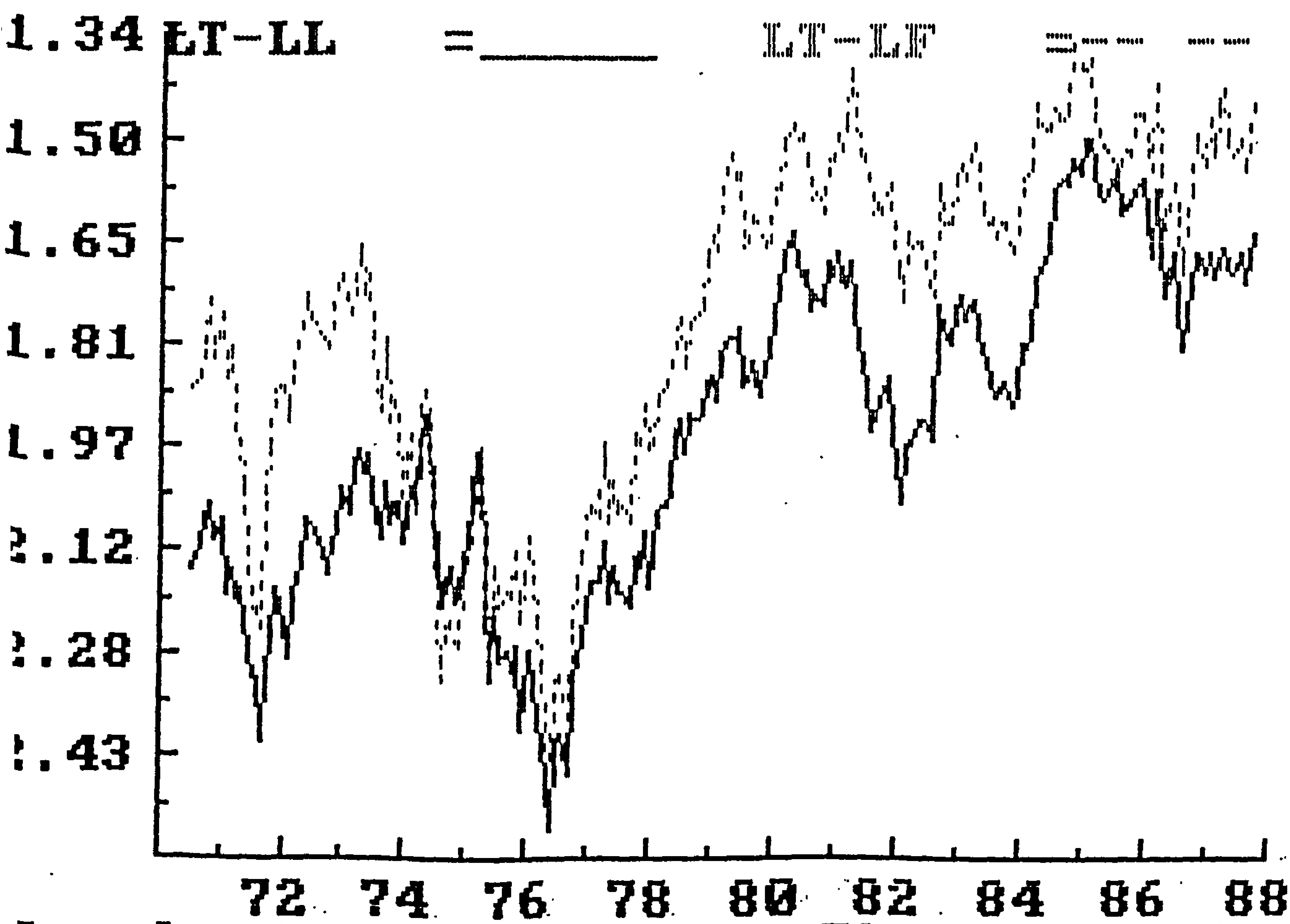


Sample Period is 1970(7) - 1987(10)

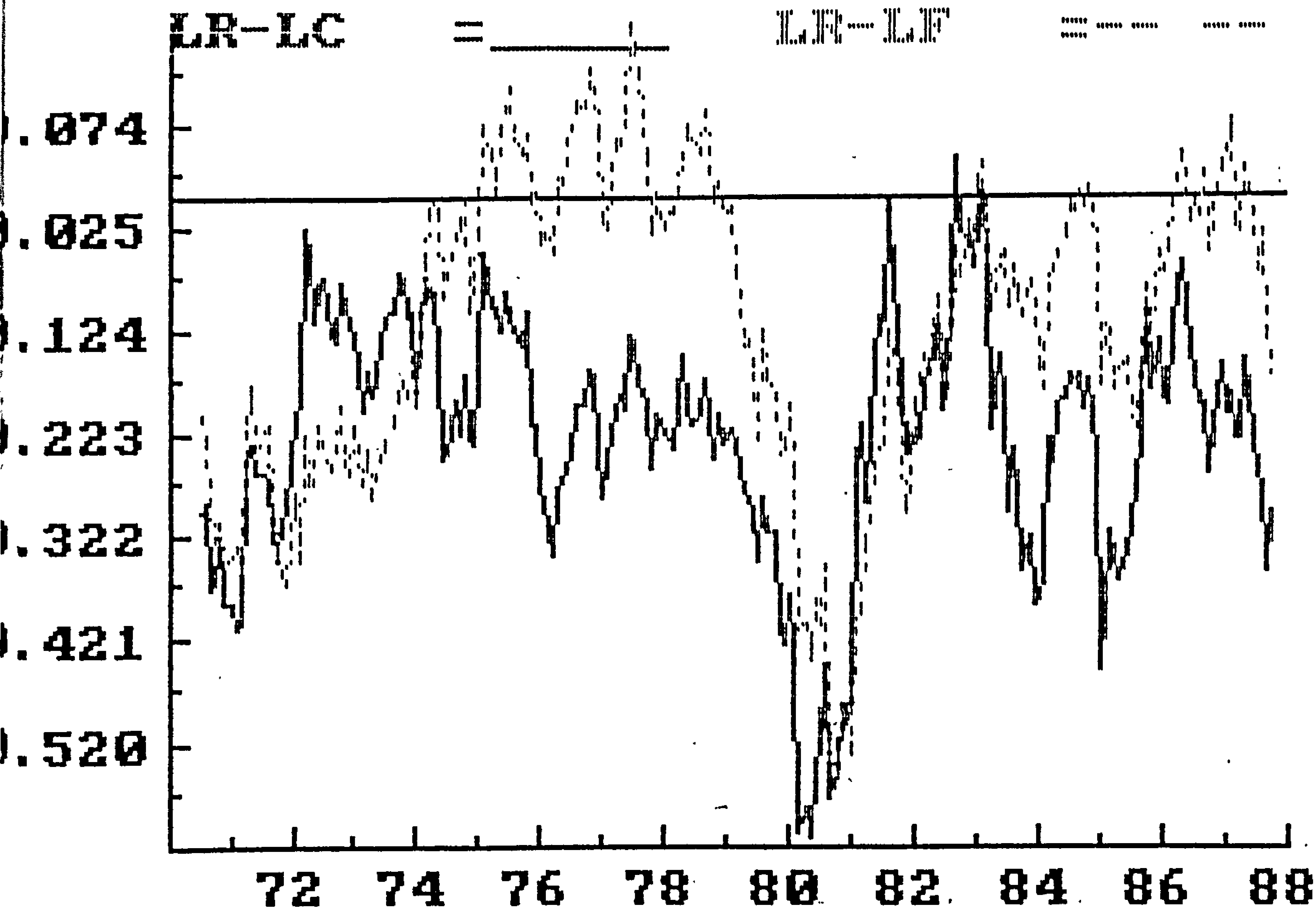




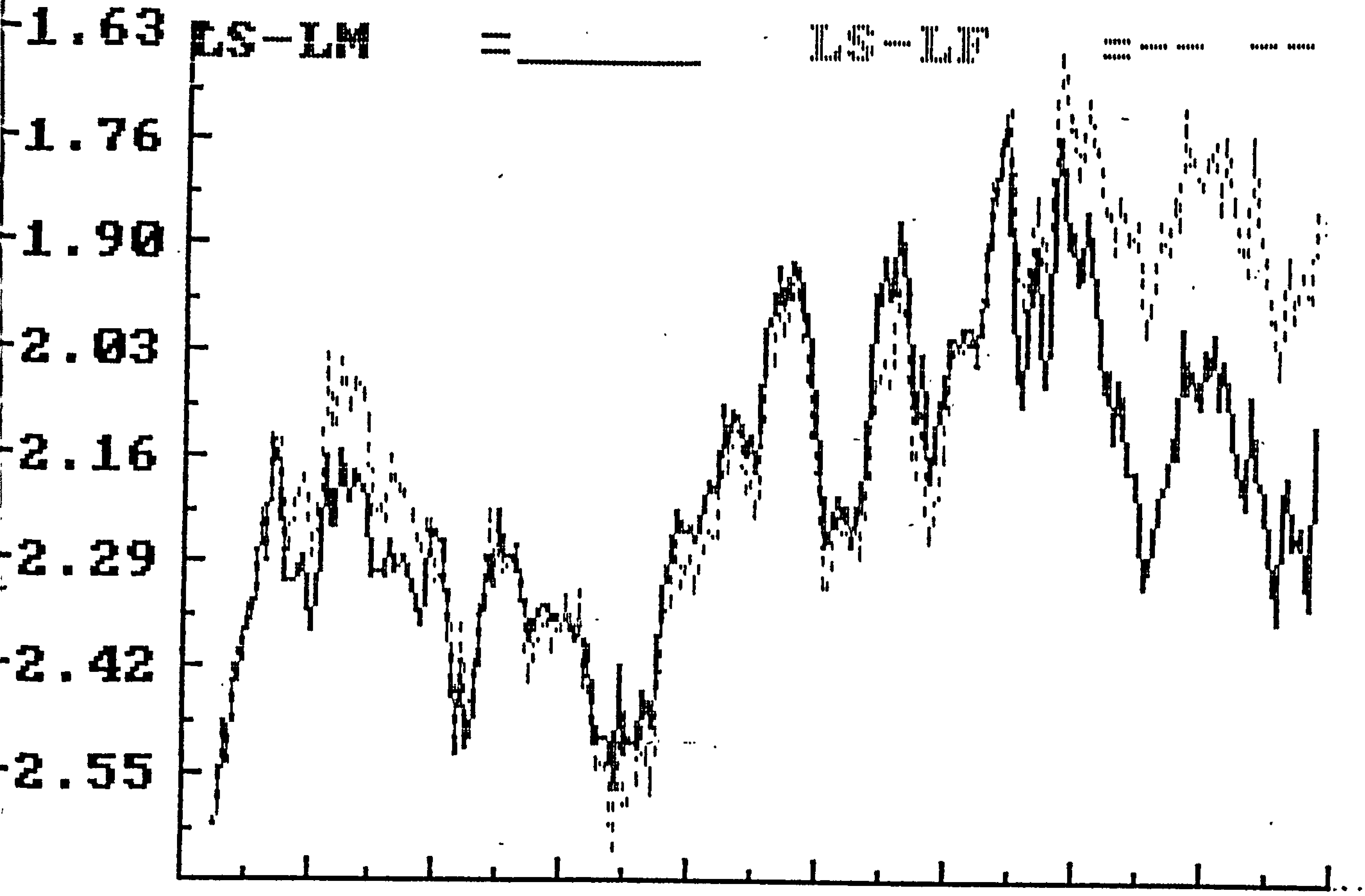
Sample Period is 1970(7) - 1987(10)



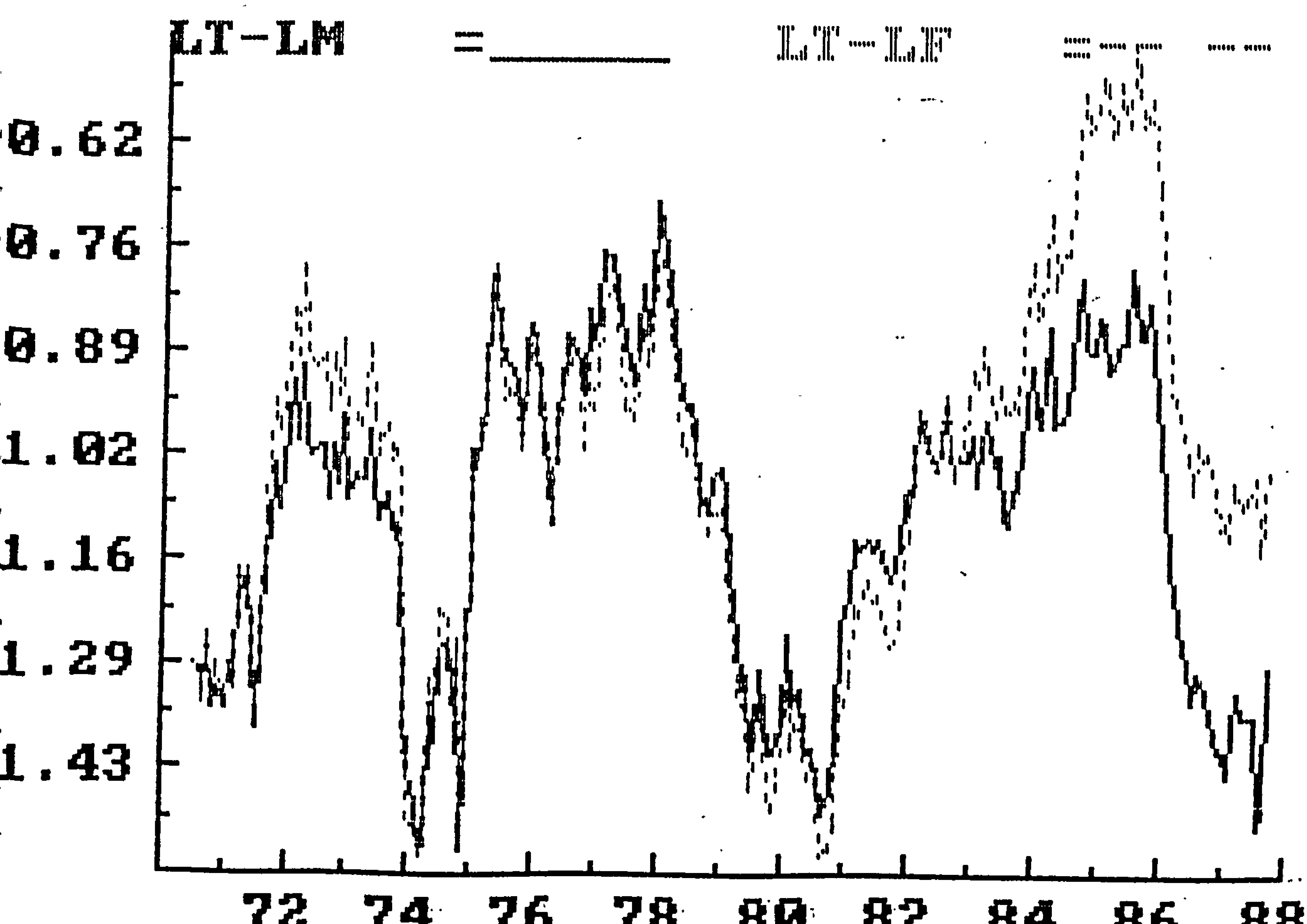
Sample Period is 1970(7) - 1987(10)

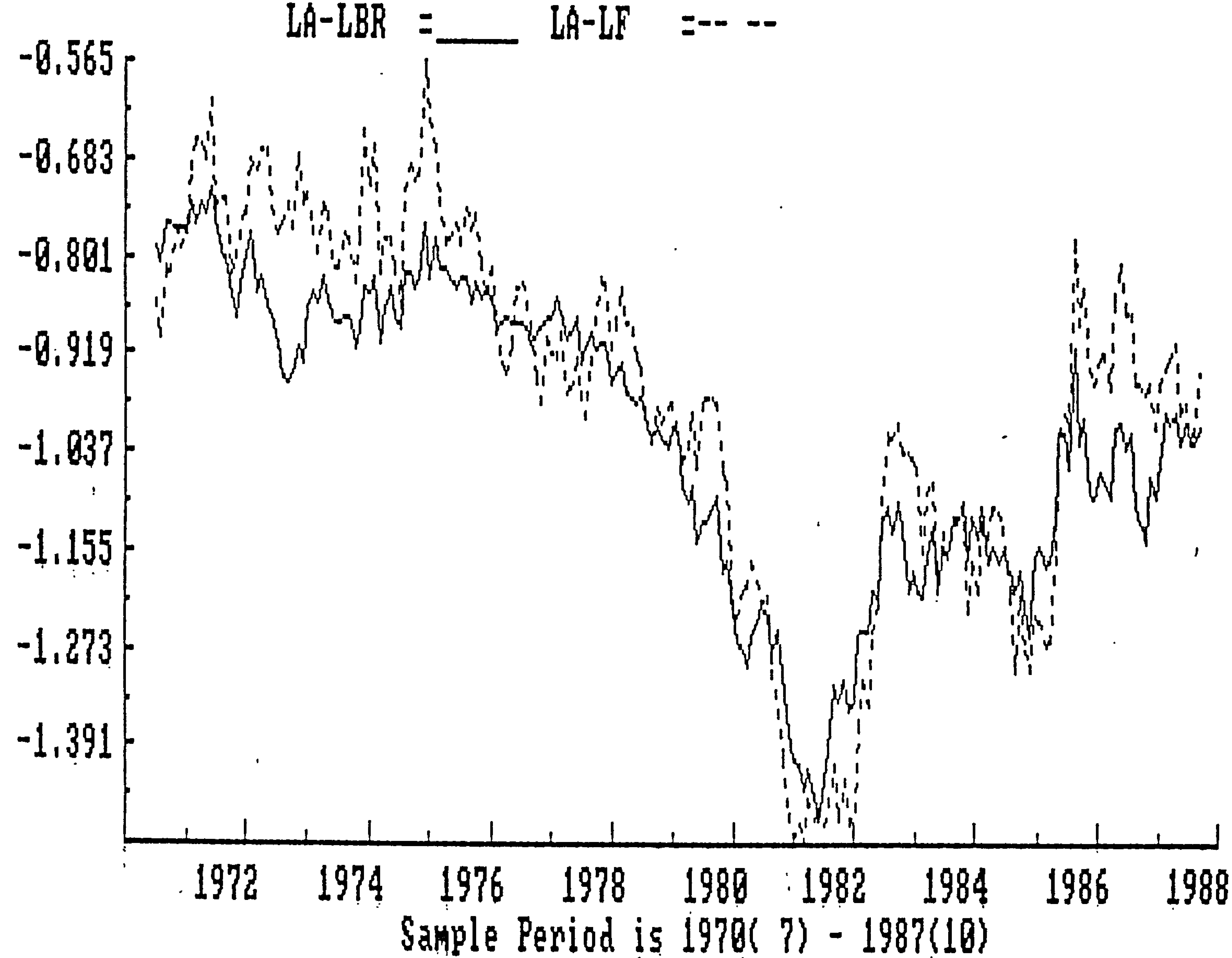


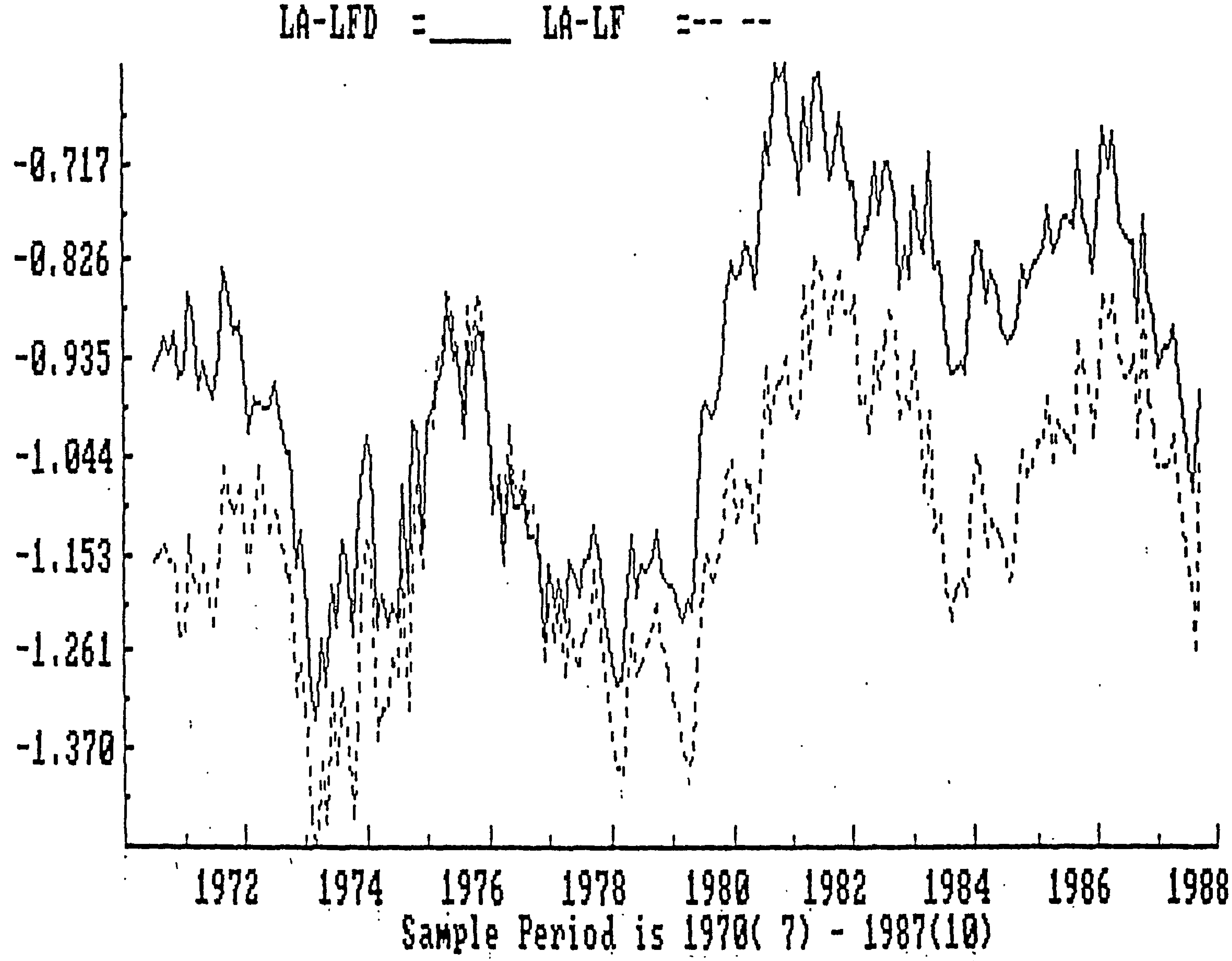
Sample Period is 1970(7) - 1987(10)

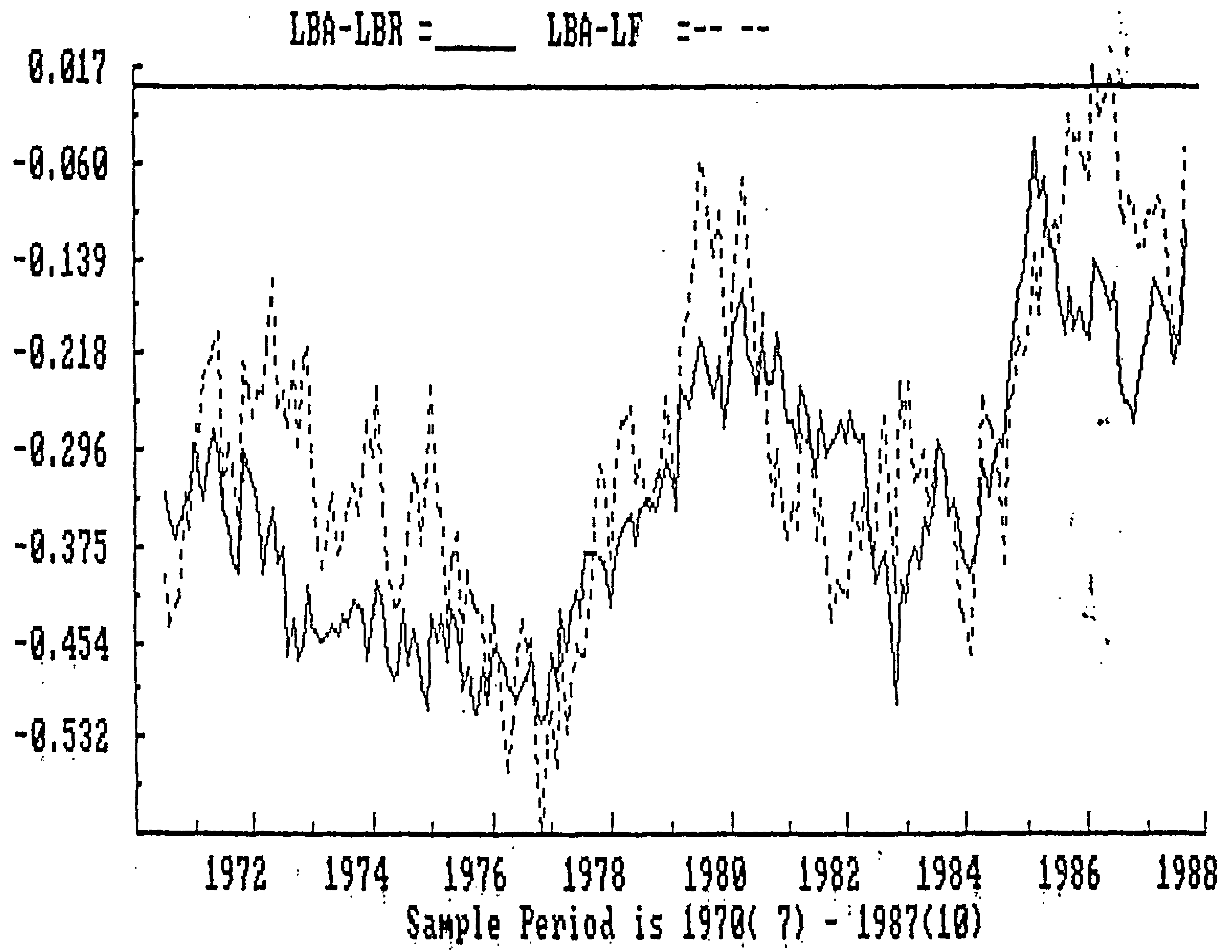


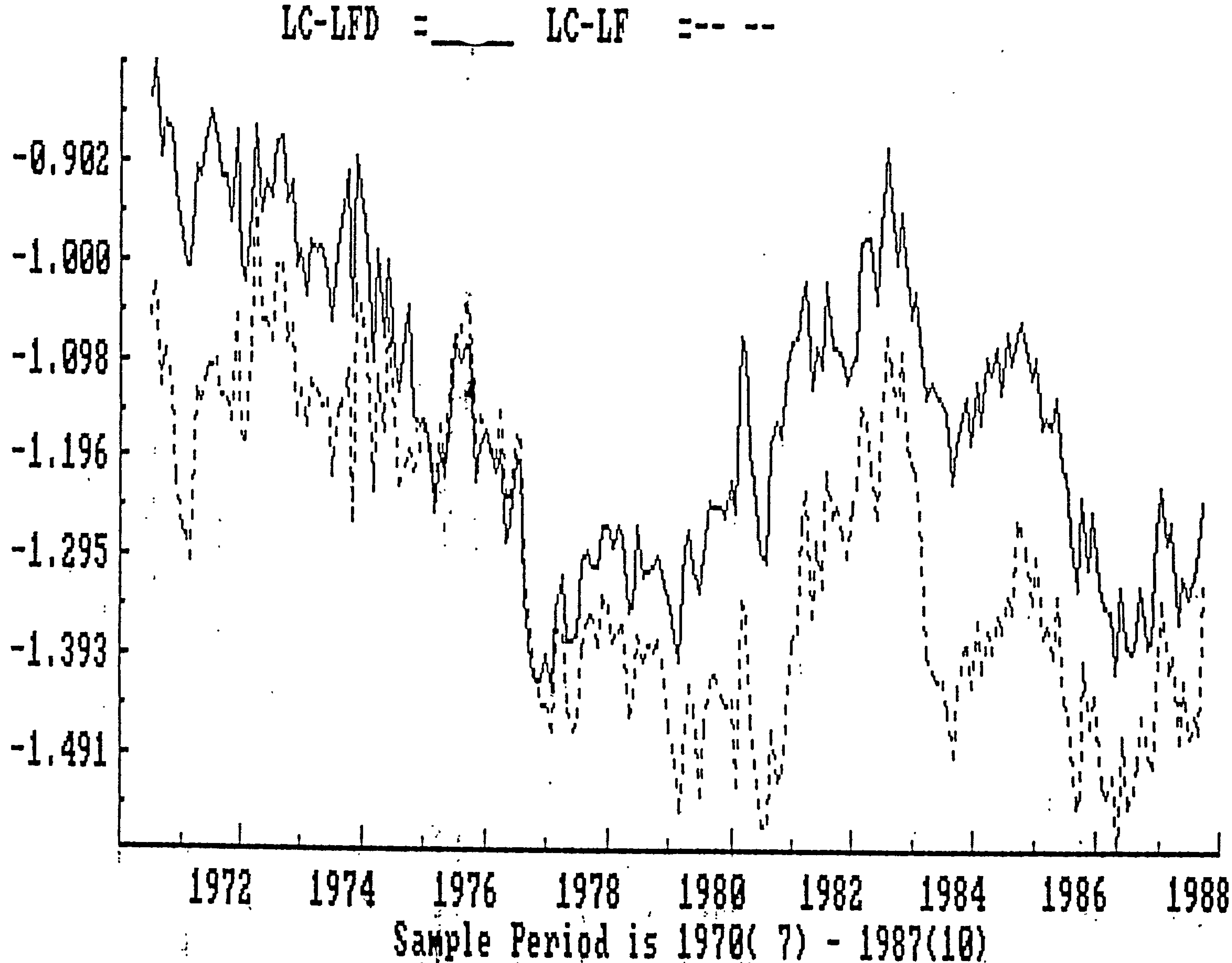
Sample Period is 1970(7) - 1987(10)



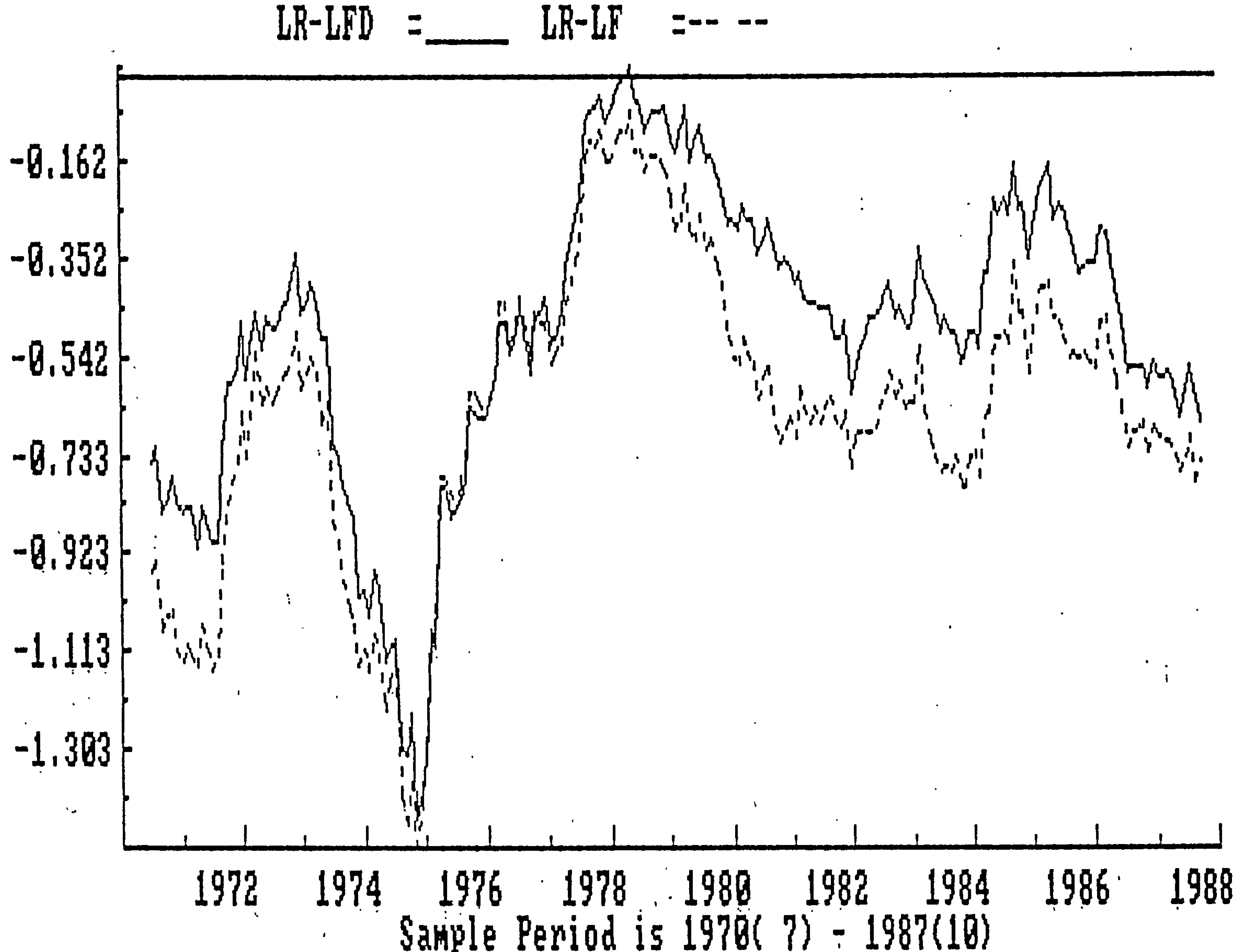

LA-LBR =____ LA-LF =-- --
-0.565
-0.683
-0.801
-0.919
-1.037
-1.155
-1.273
-1.391
1972
1974
1976
1978
1980
1982
1984
1986
1988
Sample Period is 1970(7) - 1987(10)

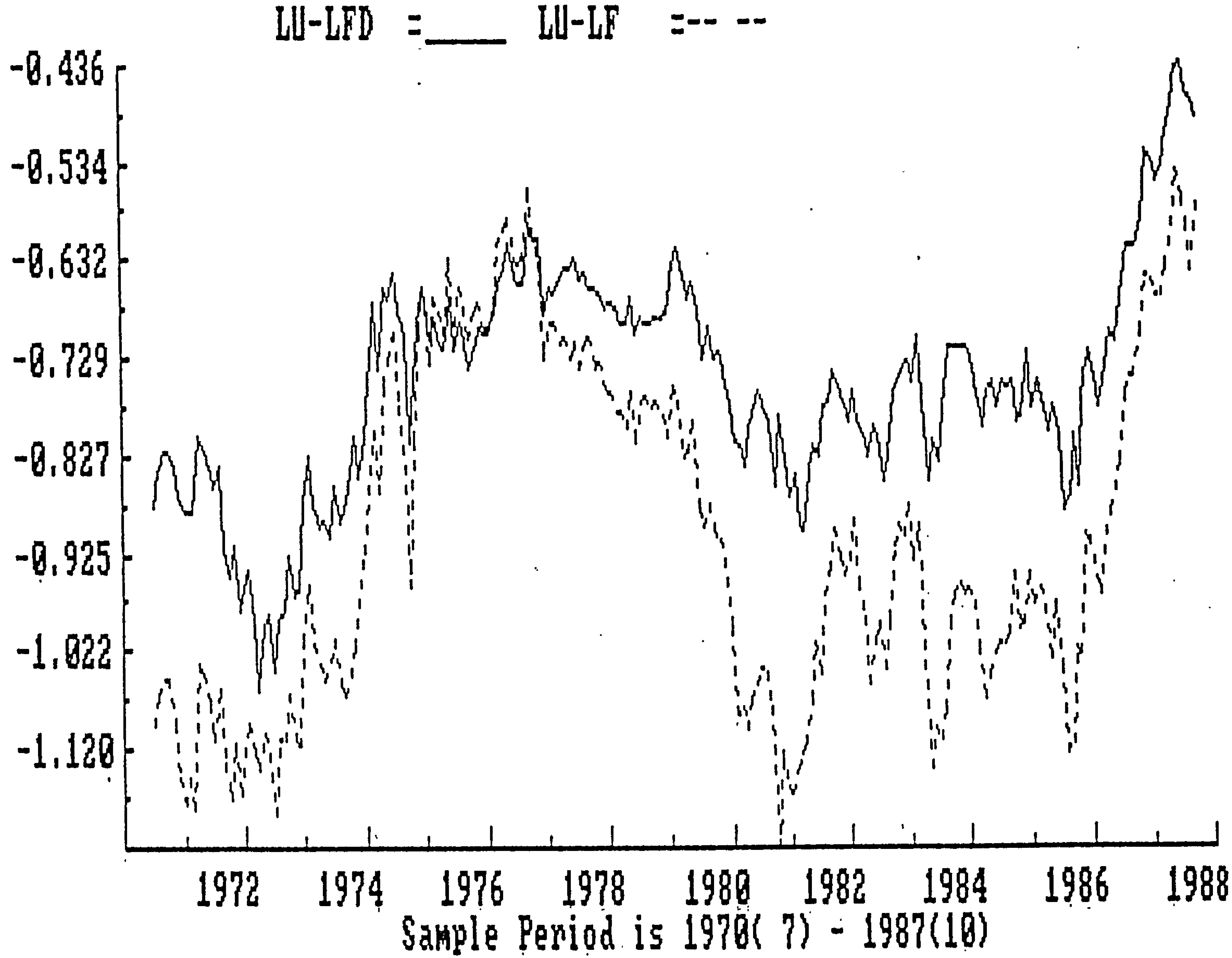

LA-LFD =____ LA-LF =-- --
-0.717
-0.826
-0.935
-1.044
-1.153
-1.261
-1.370
1972
1974
1976
1978
1980
1982
1984
1986
1988
Sample Period is 1970(7) - 1987(10)


LBA-LBR =____ LBA-LF =-- --
0.017
-0.060
-0.139
-0.218
-0.296
-0.375
-0.454
-0.532
1972
1974
1976
1978
1980
1982
1984
1986
1988
Sample Period is 1970(7) - 1987(10)

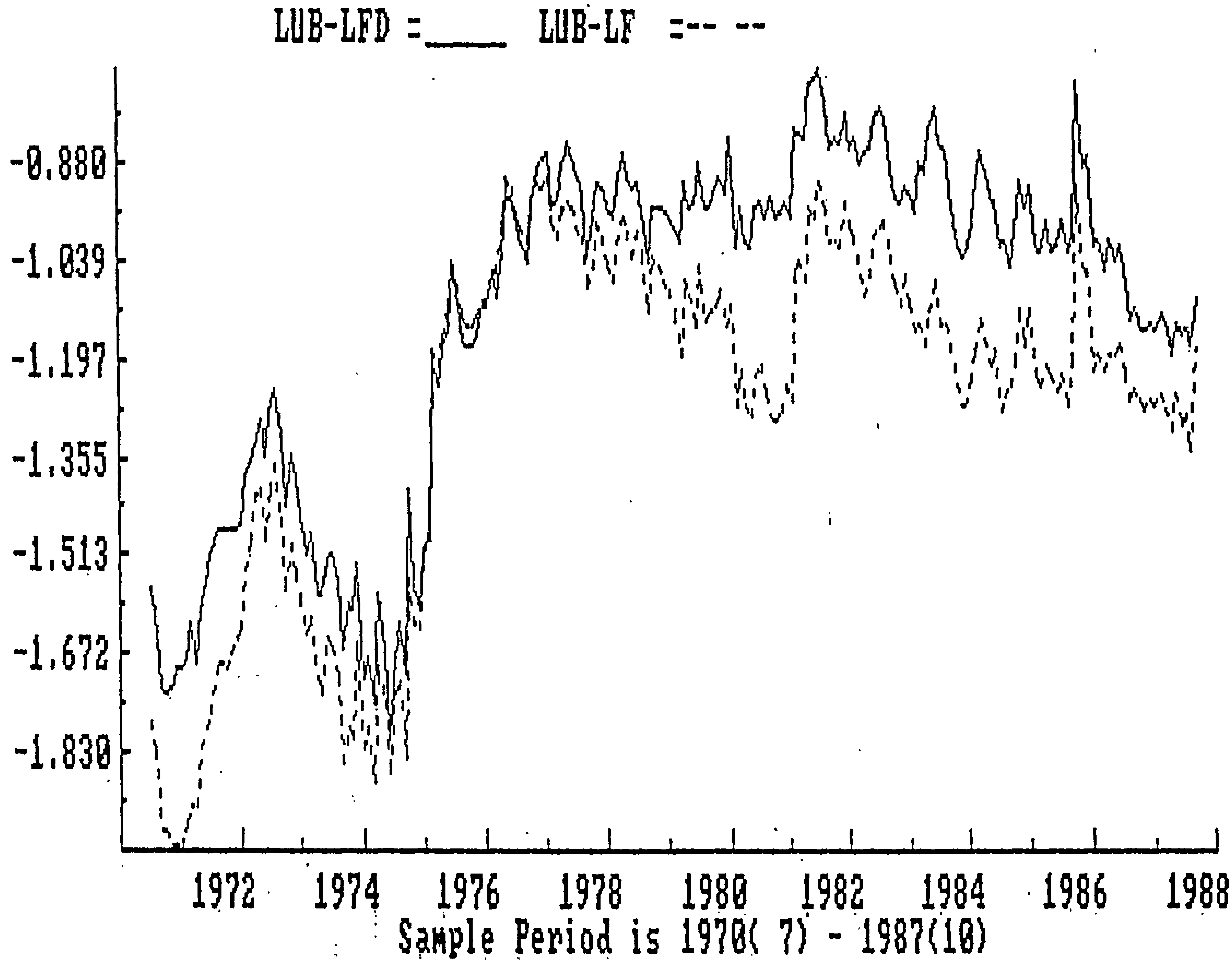


LC-LFD =
LC-LF =-- --
-0.902
-1.000
-1.098
-1.196
-1.295
-1.393
-1.491
1972
1974
1976
1978
1980
1982
1984
1986
1988
Sample Period is 1970(7) - 1987(10)

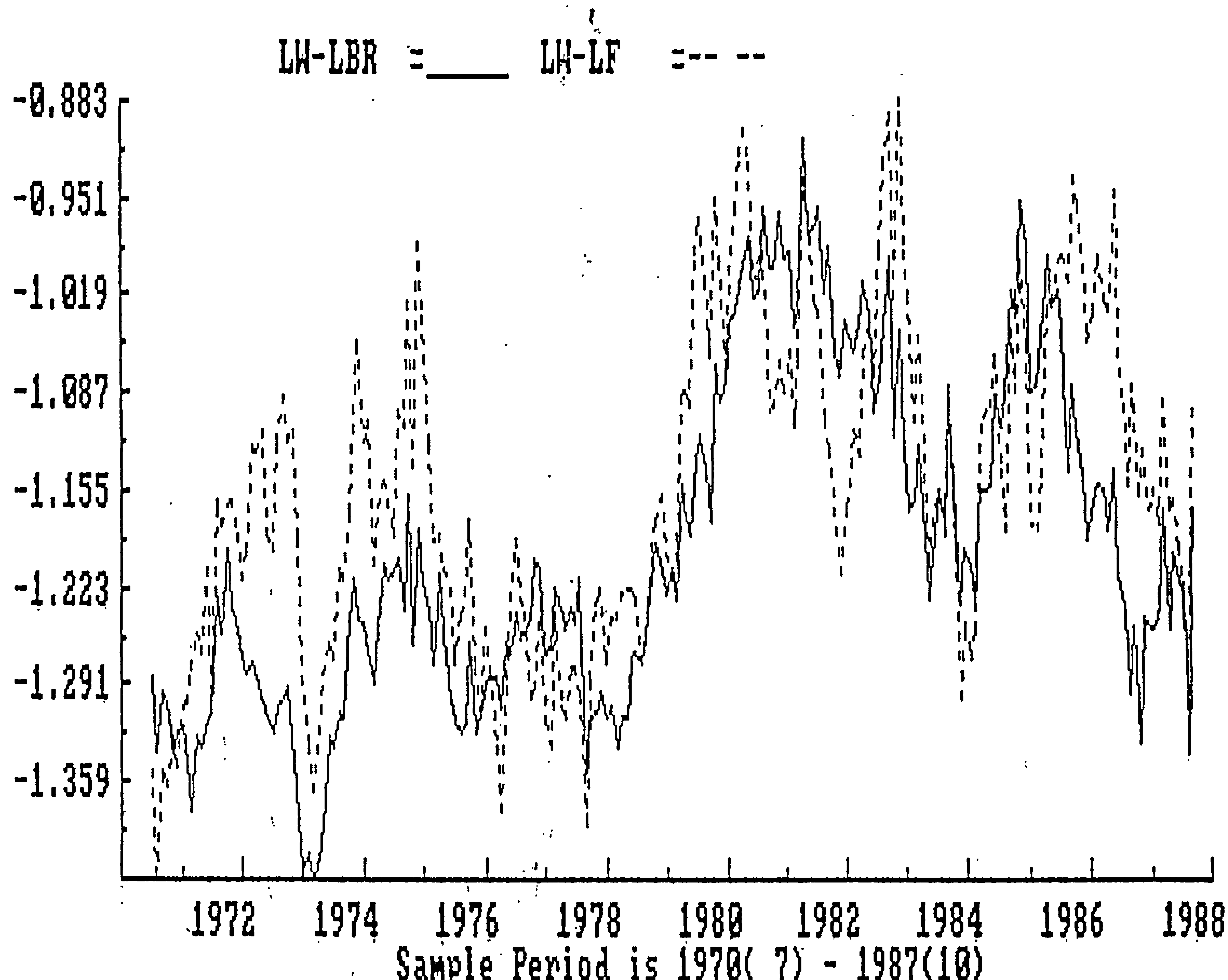

LR-LFD =____ LR-LF =-- --
-0.162
-0.352
-0.542
-0.733
-0.923
-1.113
-1.303
1972
1974
1976
1978
1980
1982
1984
1986
1988
Sample Period is 1970(7) - 1987(10)

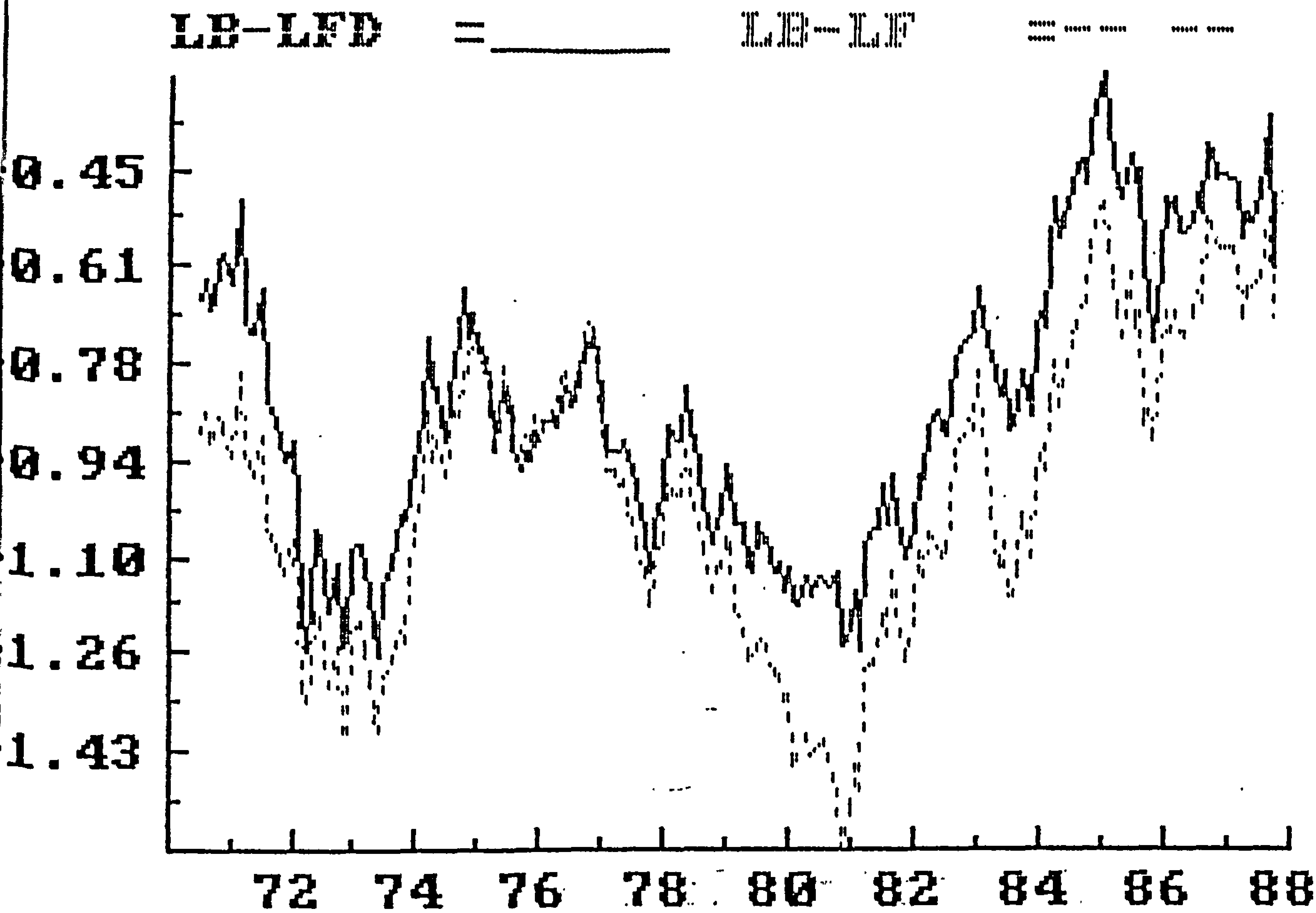


LU-LFD =____ LU-LF =-- --
-0.436
-0.534
-0.632
-0.729
-0.827
-0.925
-1.022
-1.120
1972
1974
1976
1978
1980
1982
1984
1986
1988
Sample Period is 1970(7) - 1987(10)

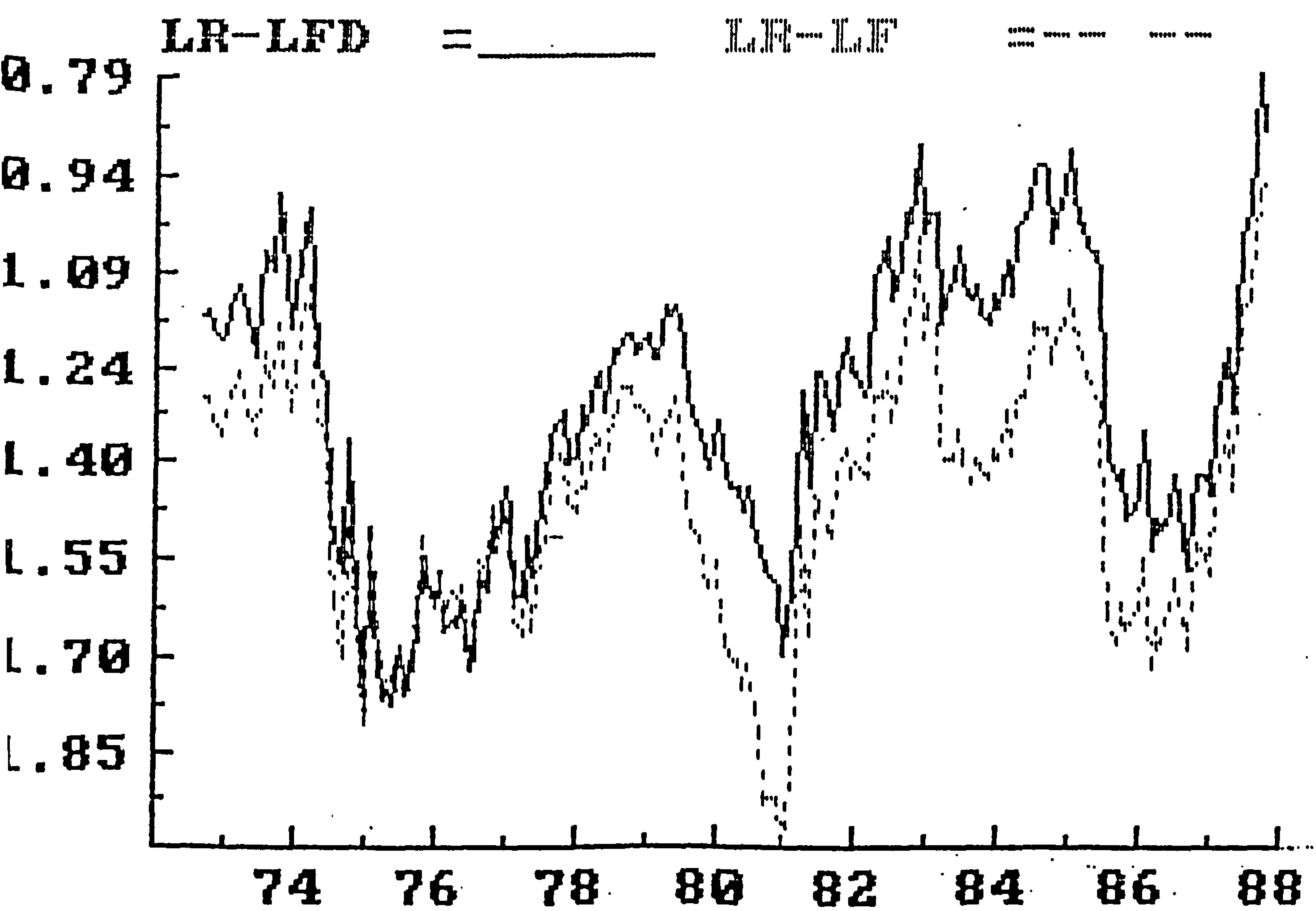


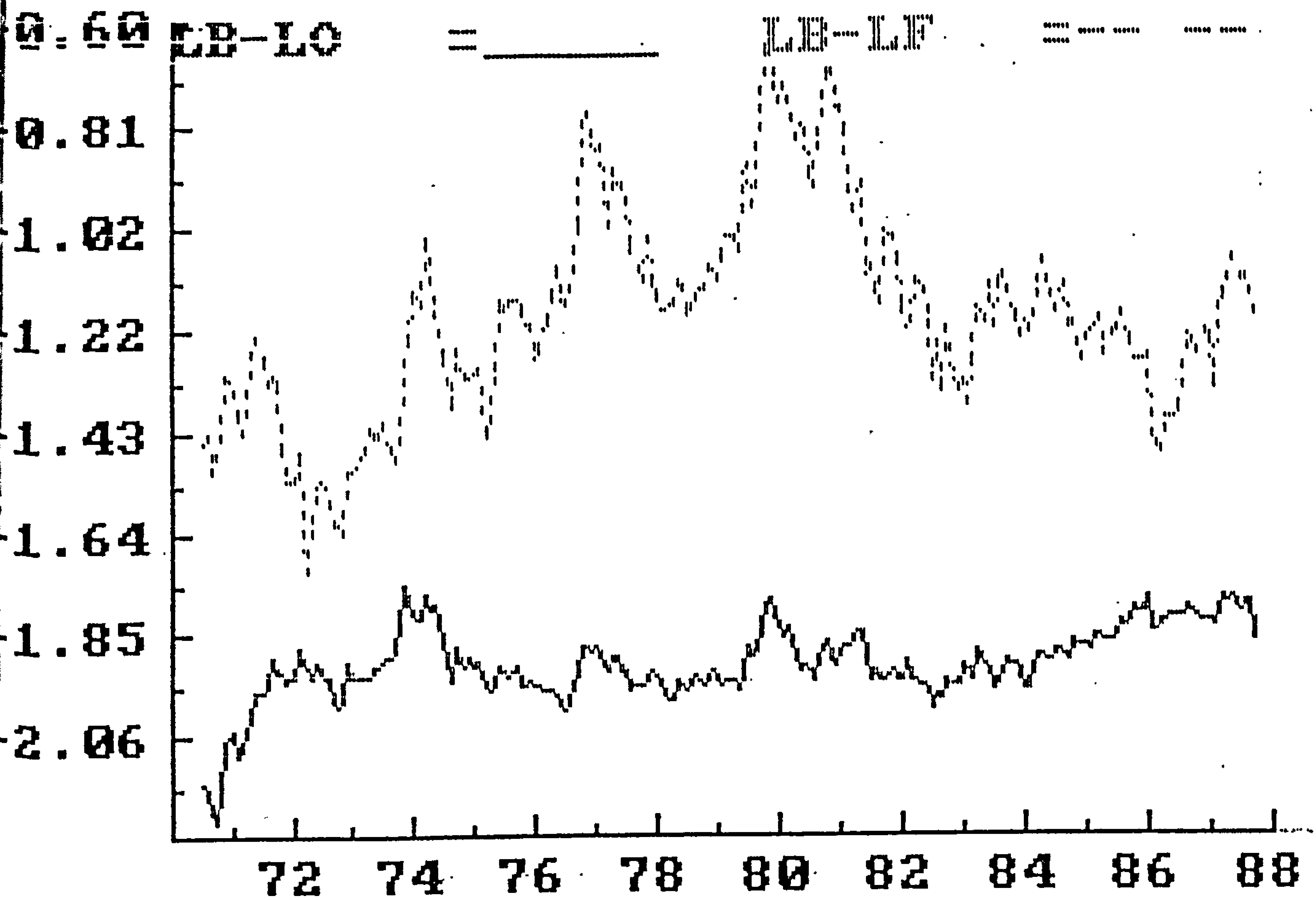
LUB-LFD =____ LUB-LF =-- --
-0.880
-1.039
-1.197
-1.355
-1.513
-1.672
-1.830
1972
1974
1976
1978
1980
1982
1984
1986
1988
Sample Period is 1970(7) - 1987(10)


LW-LBR =____ LW-LF =-- --
-0.883
-0.951
-1.019
-1.087
-1.155
-1.223
-1.291
-1.359
1972
1974
1976
1978
1980
1982
1984
1986
1988
Sample Period is 1970(7) - 1987(10)

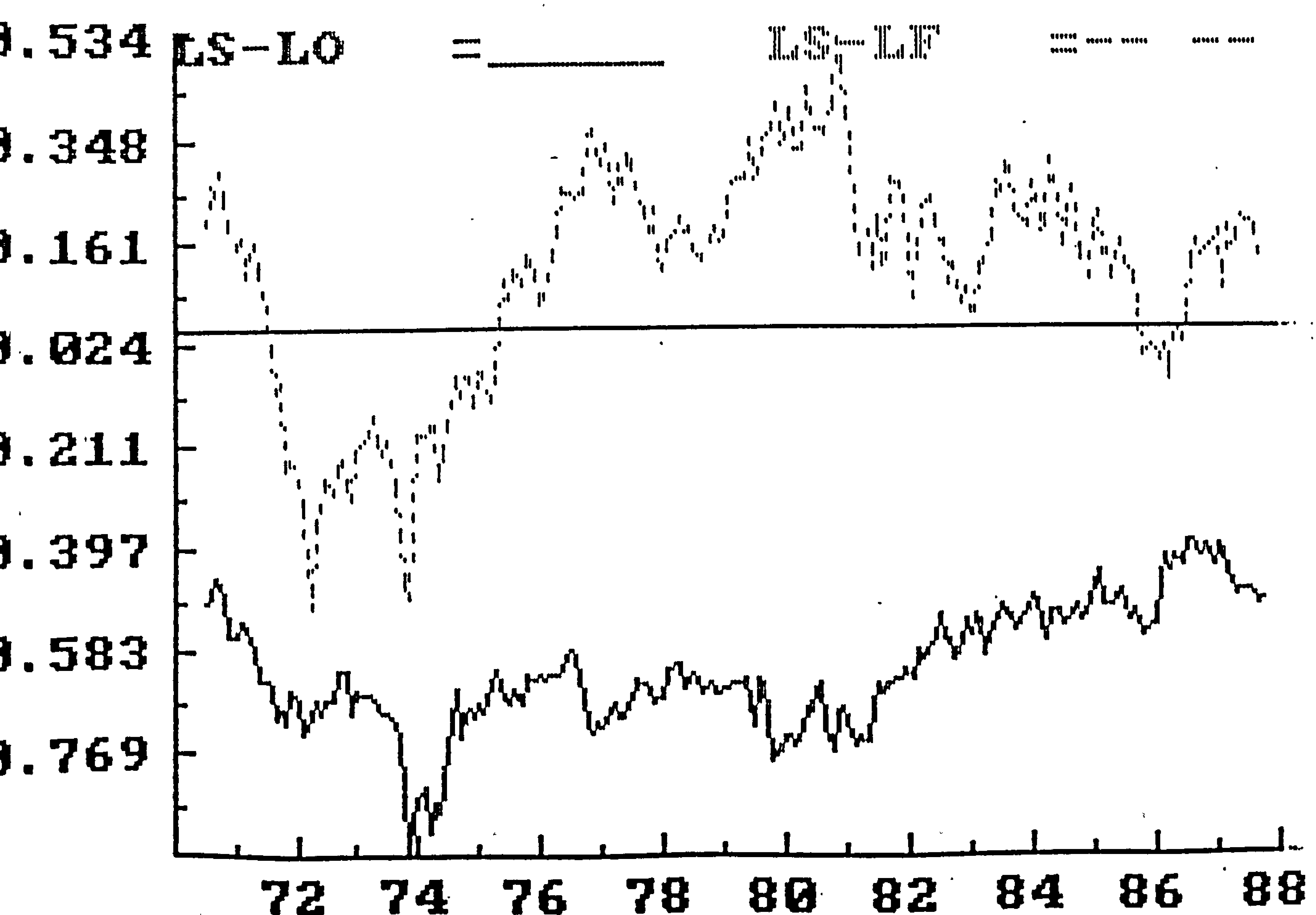


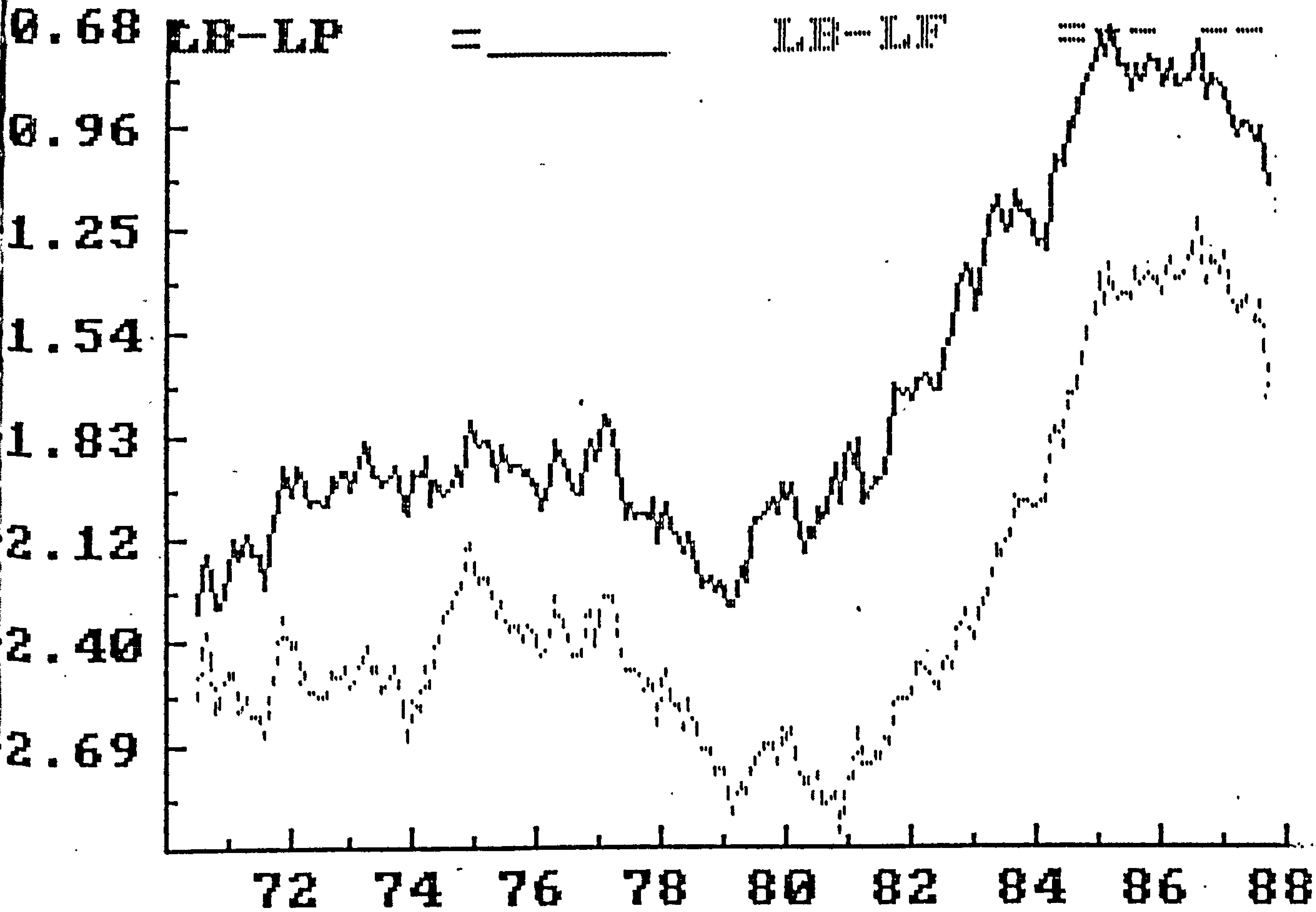
Sample Period is 1970(7) - 1987(10)



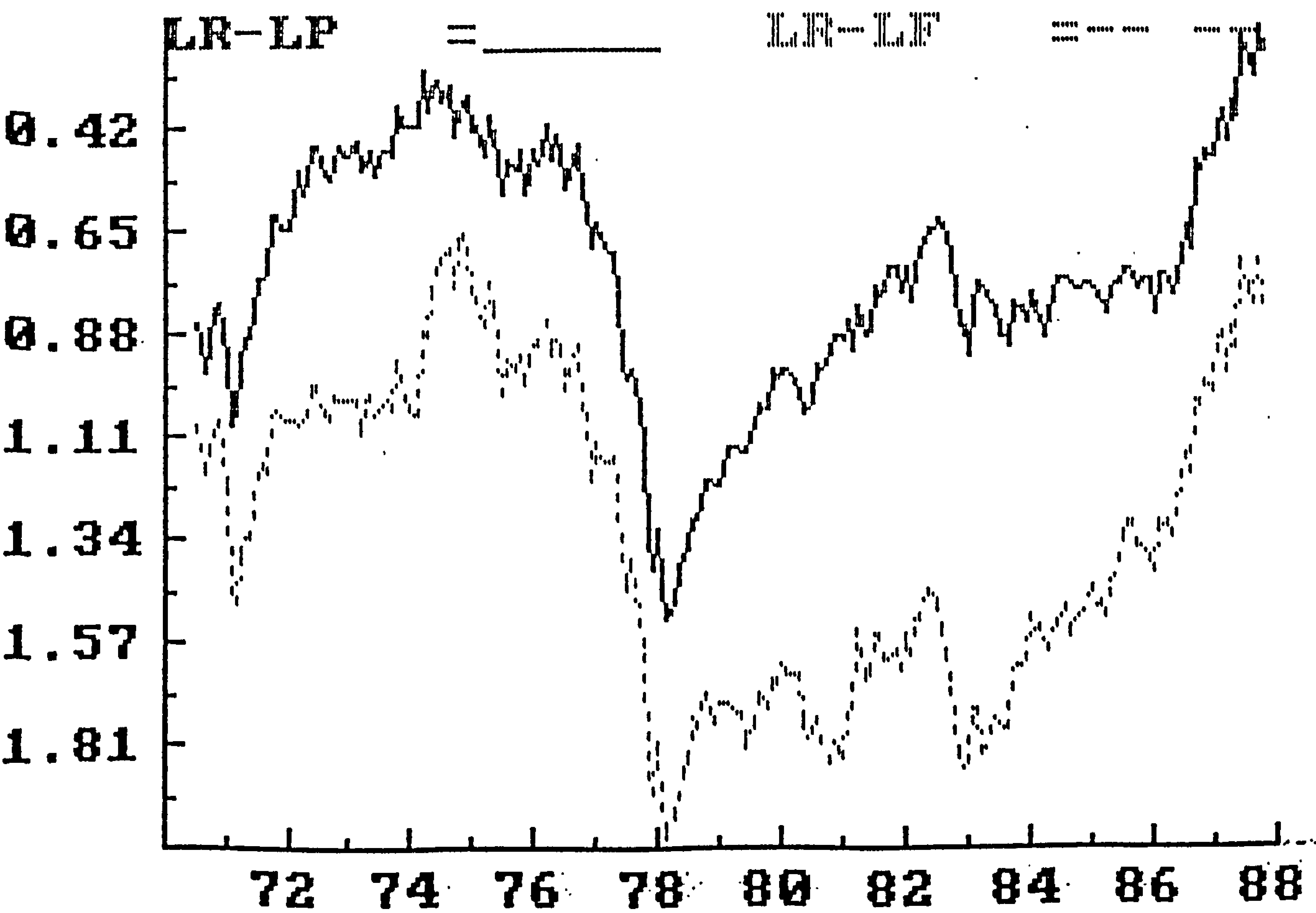


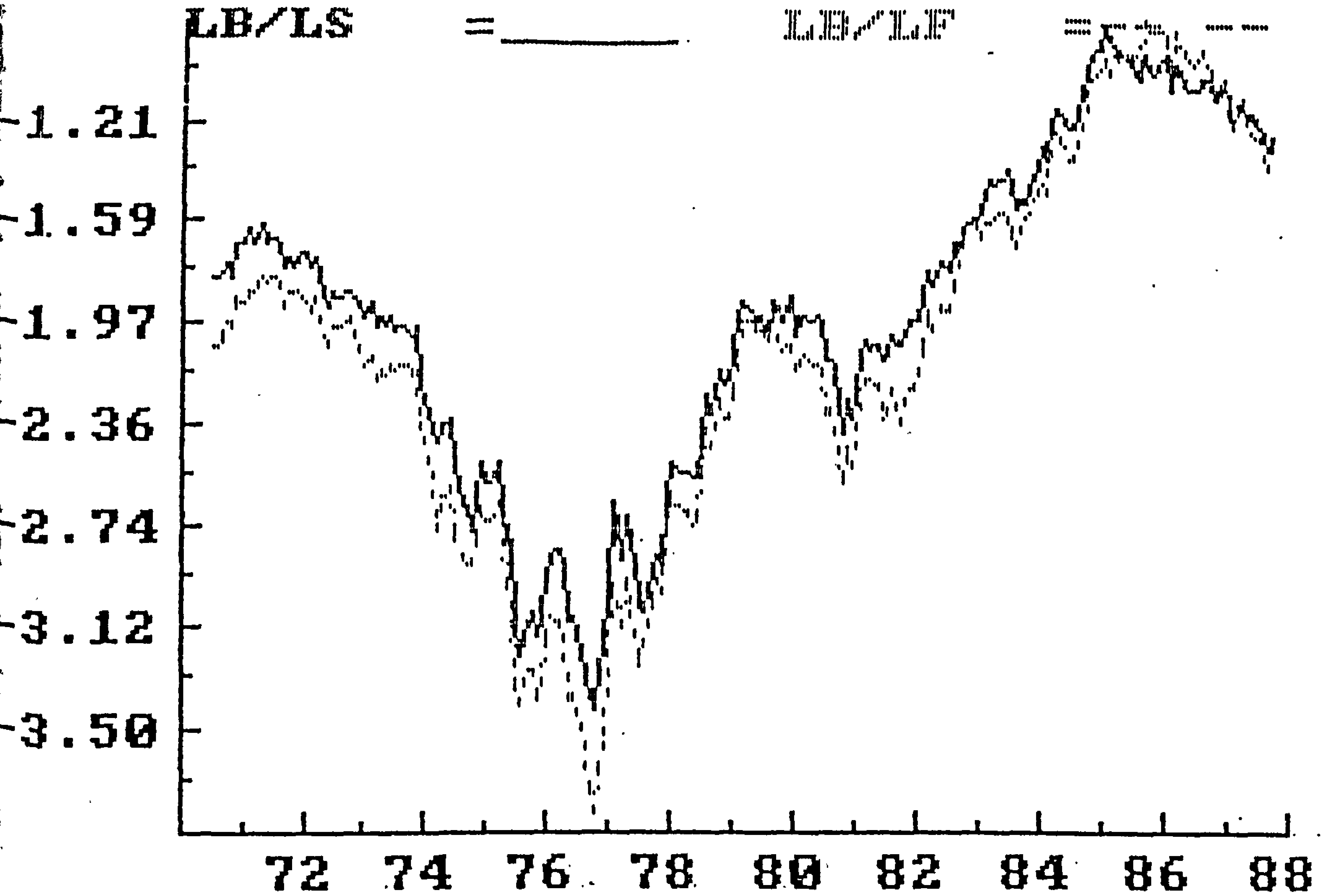
Sample Period is 1970(7) - 1987(10)



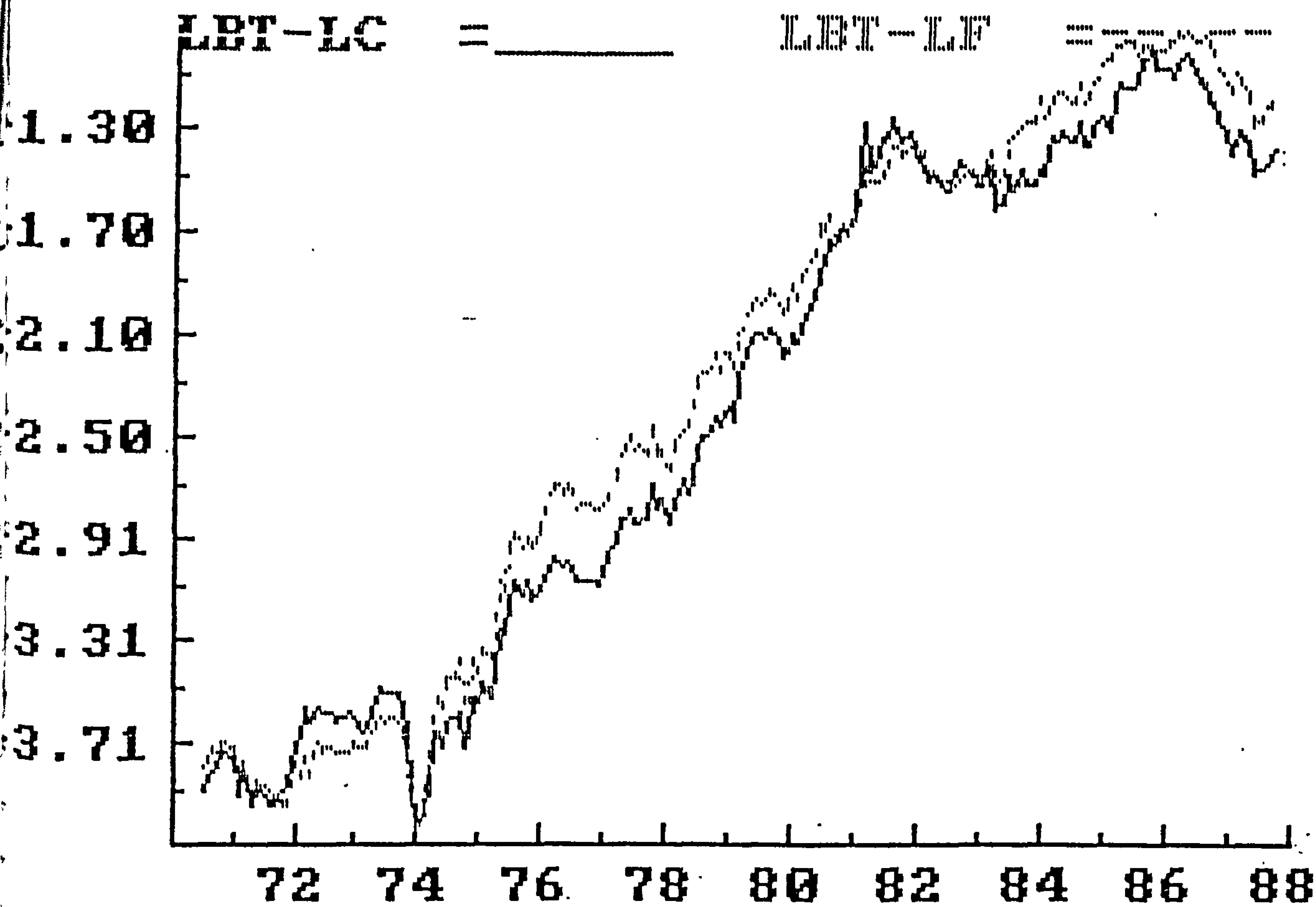


Sample Period is 1970(7) - 1987(10)

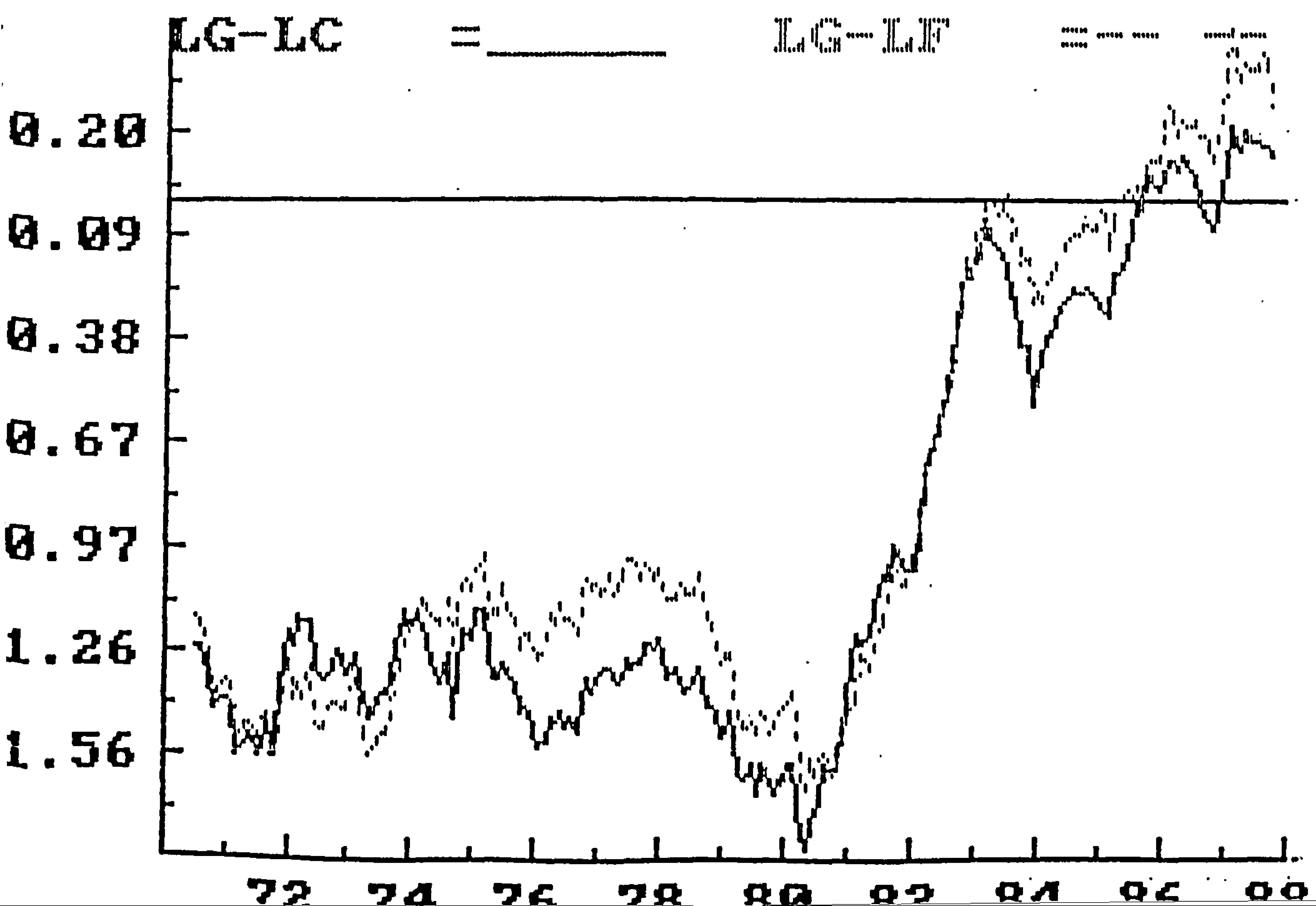


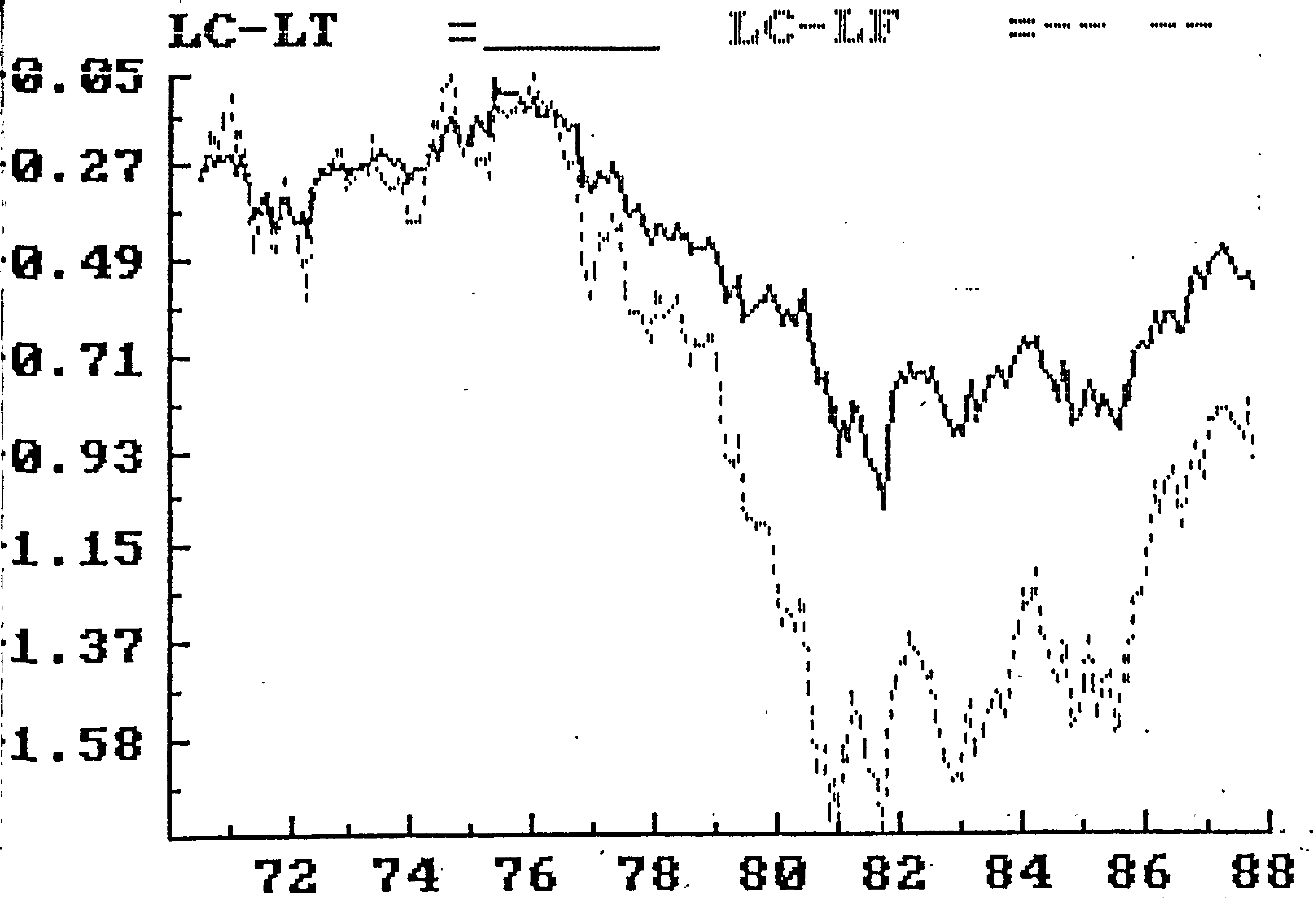


Sample Period is 1970(7) - 1987(10)

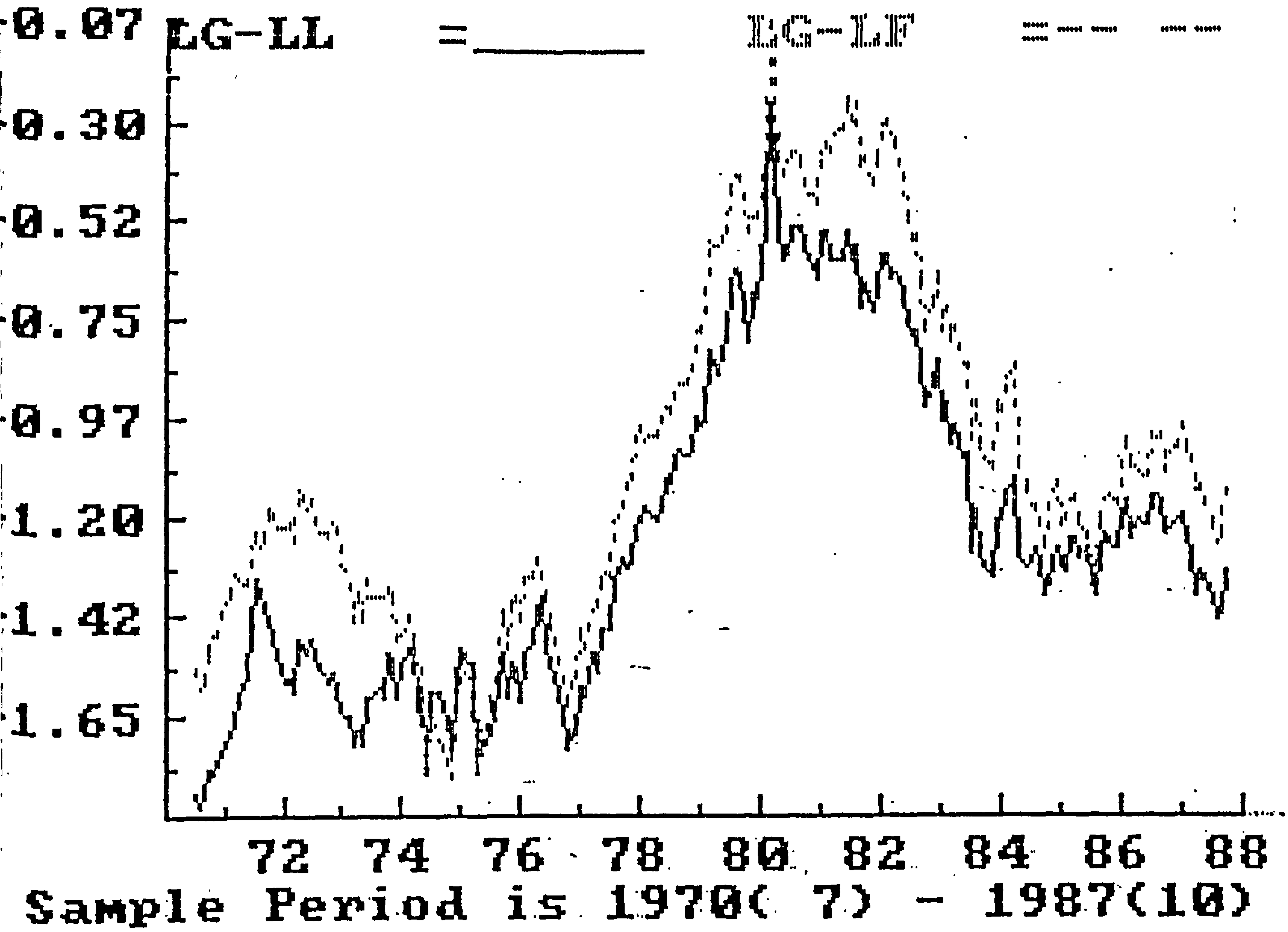


Sample Period is 1970(7) - 1987(10)

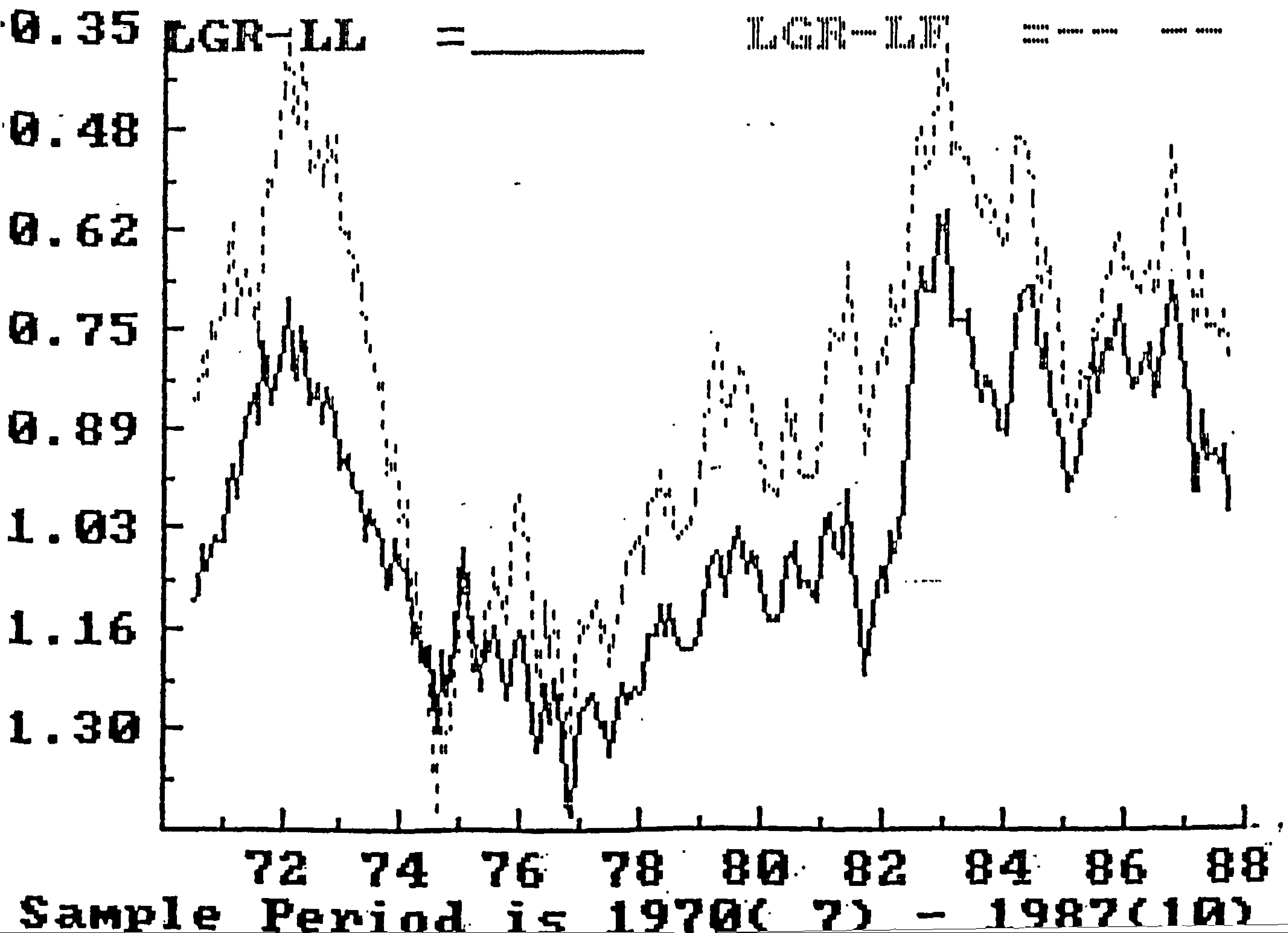




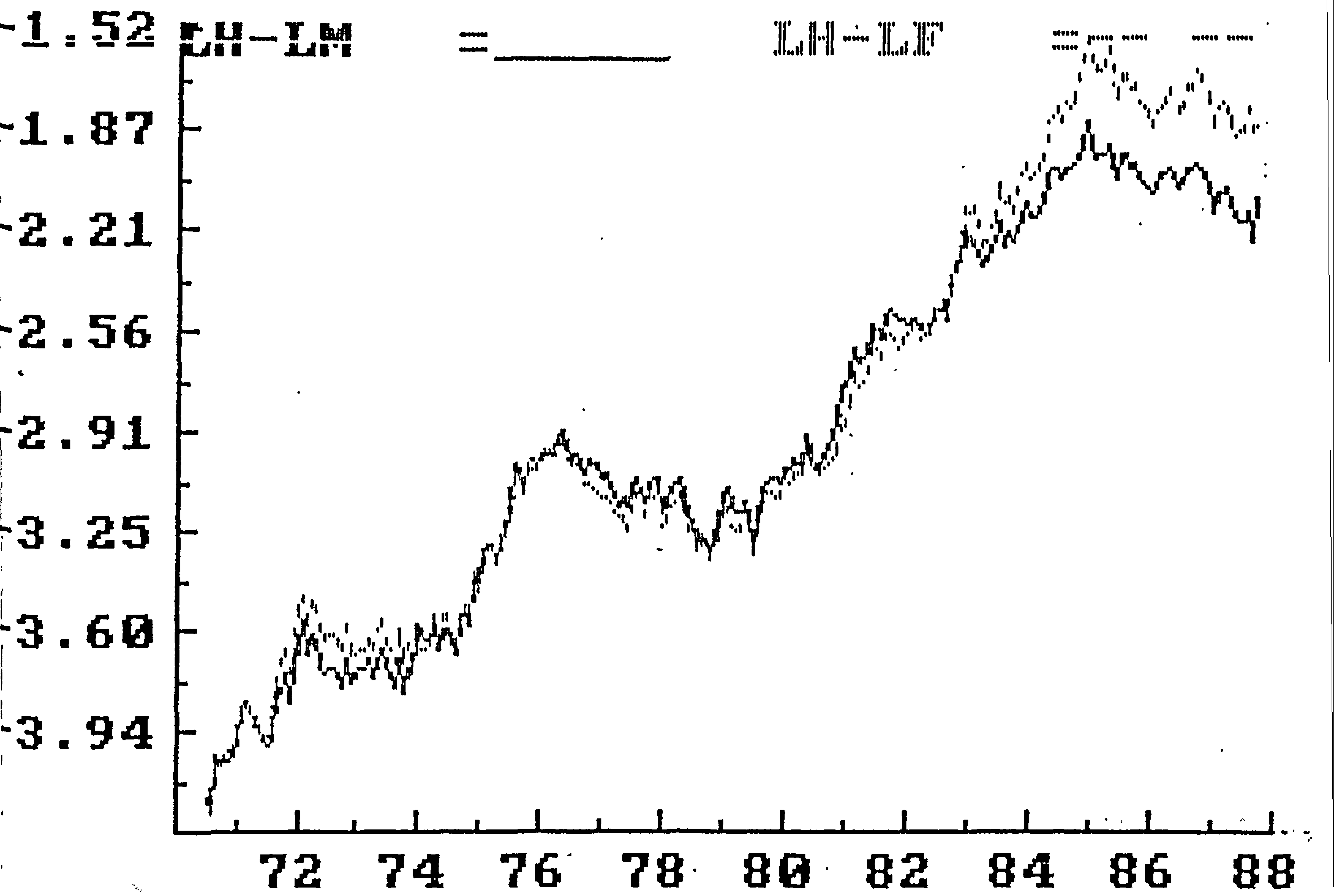
Sample Period is 1970(7) - 1987(10)



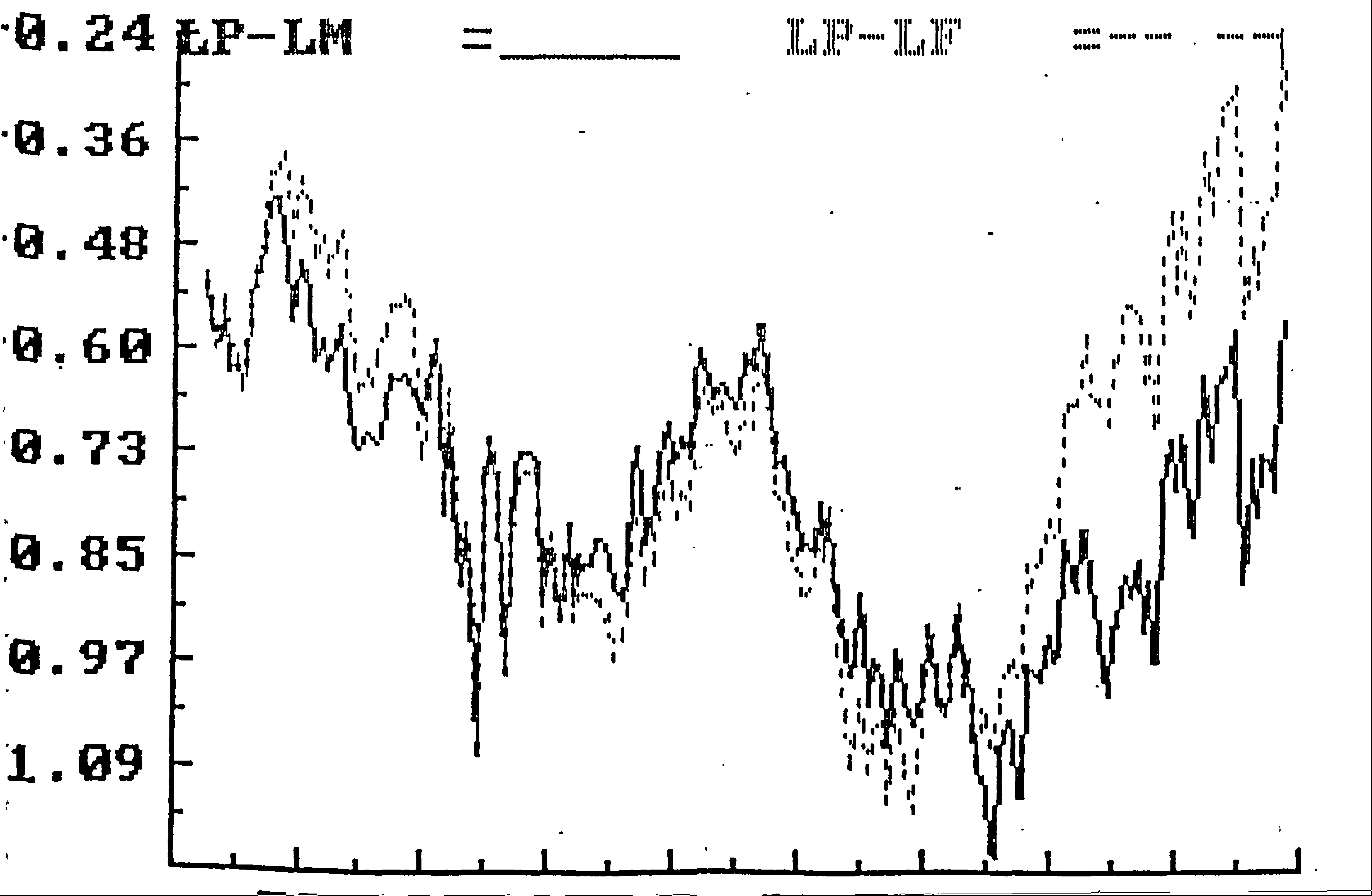
-0.07
-0.30
-0.52
-0.75
-0.97
-1.20
-1.42
-1.65
LG-LL =
LG-LF =
72 74 76 78 80 82 84 86 88
Sample Period is 1970(7) - 1987(10)

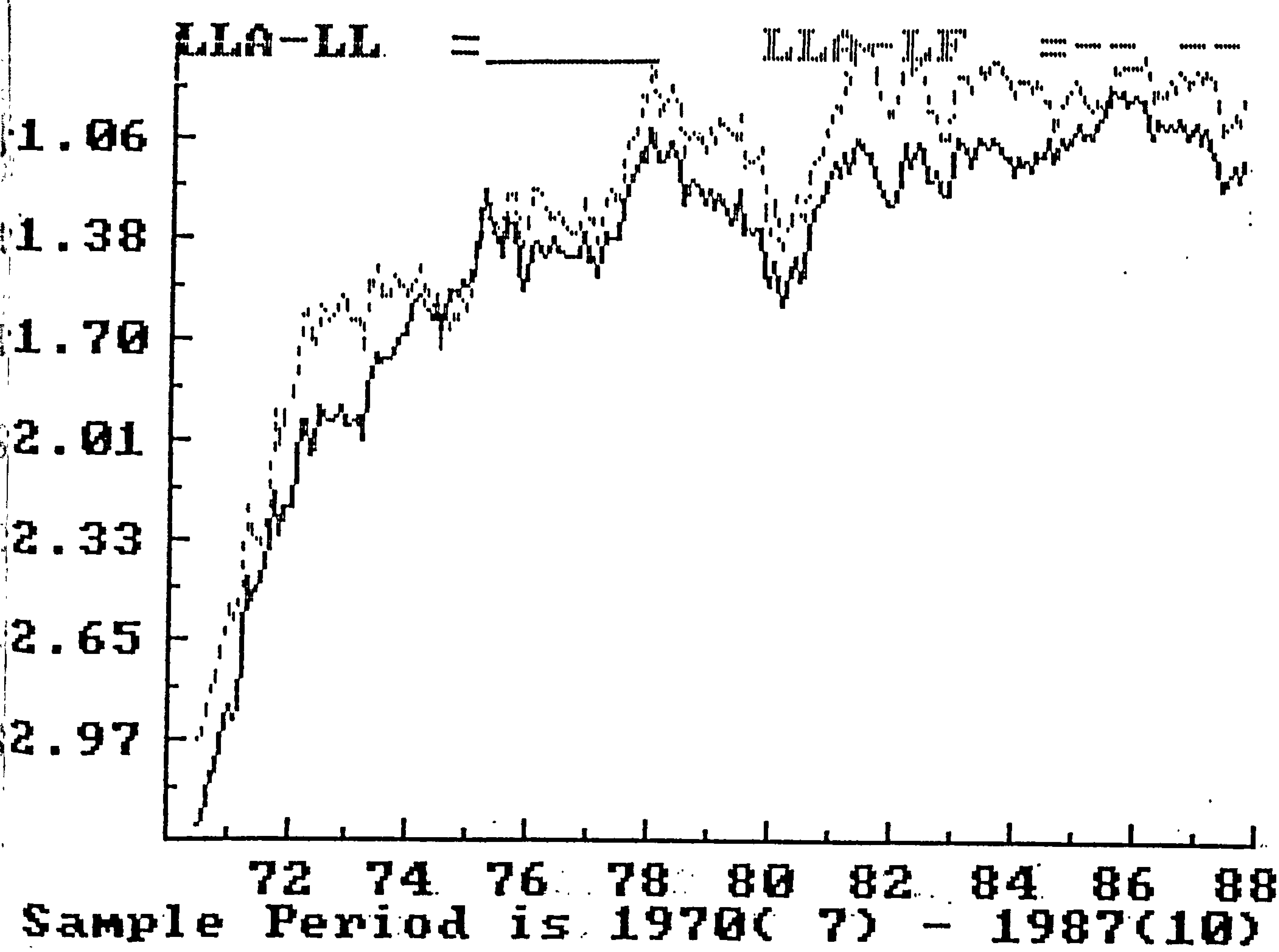


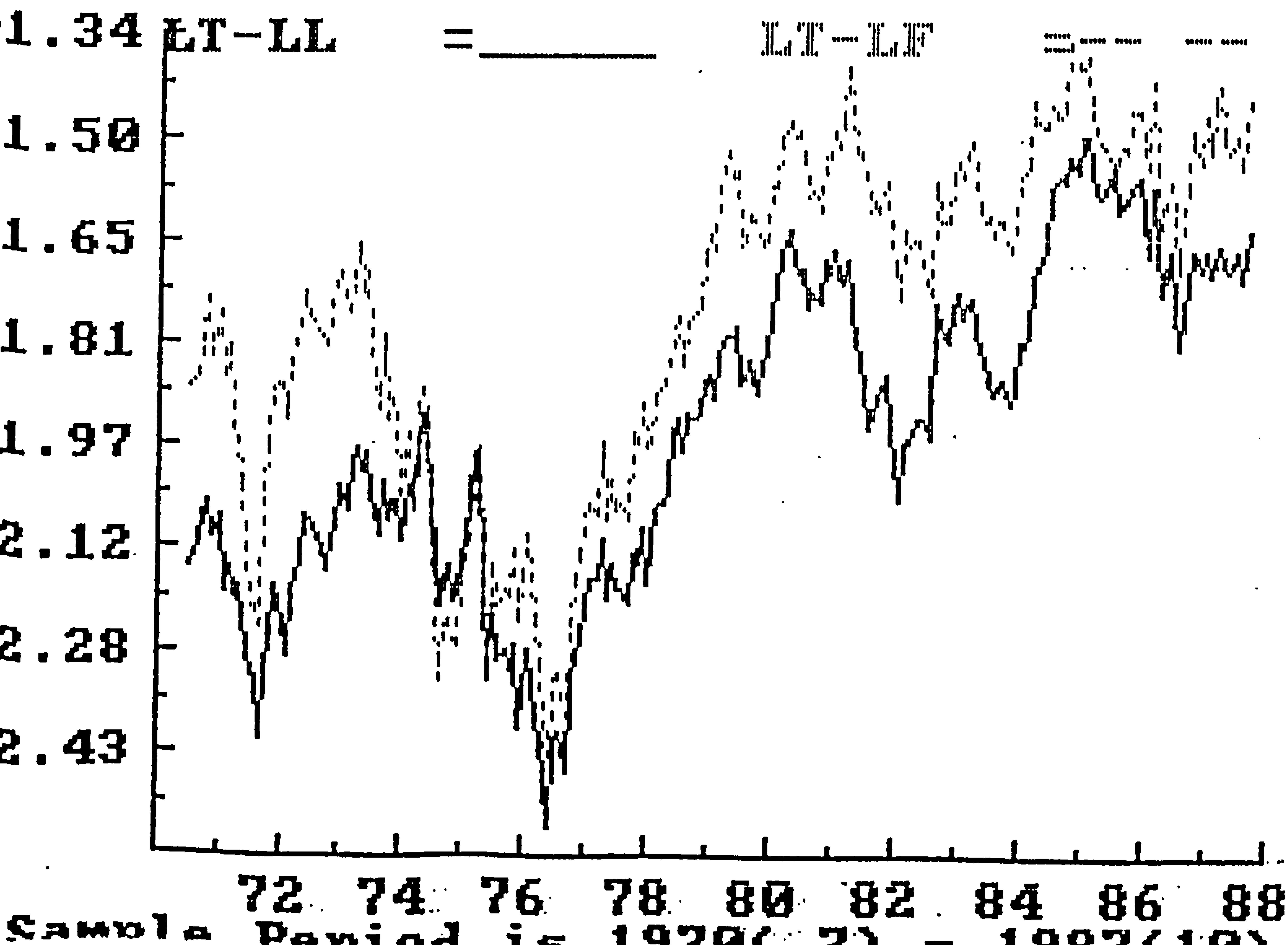
-0.35
-0.48
0.62
0.75
0.89
1.03
1.16
1.30
LGR-LL =
LGR-LF =
72 74 76 78 80 82 84 86 88
Sample Period is 1970(7) - 1987(10)

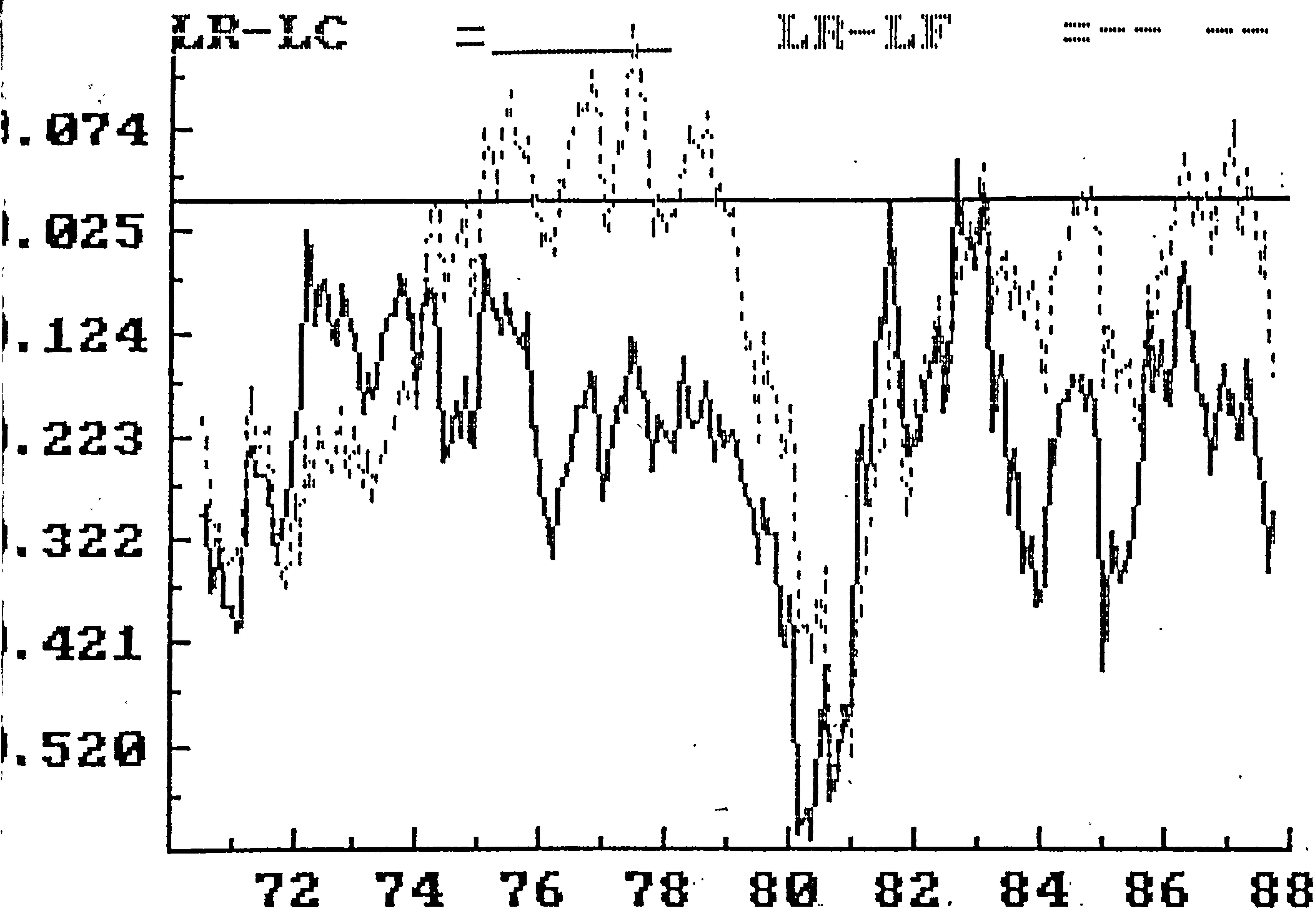


Sample Period is 1970(7) - 1987(10)

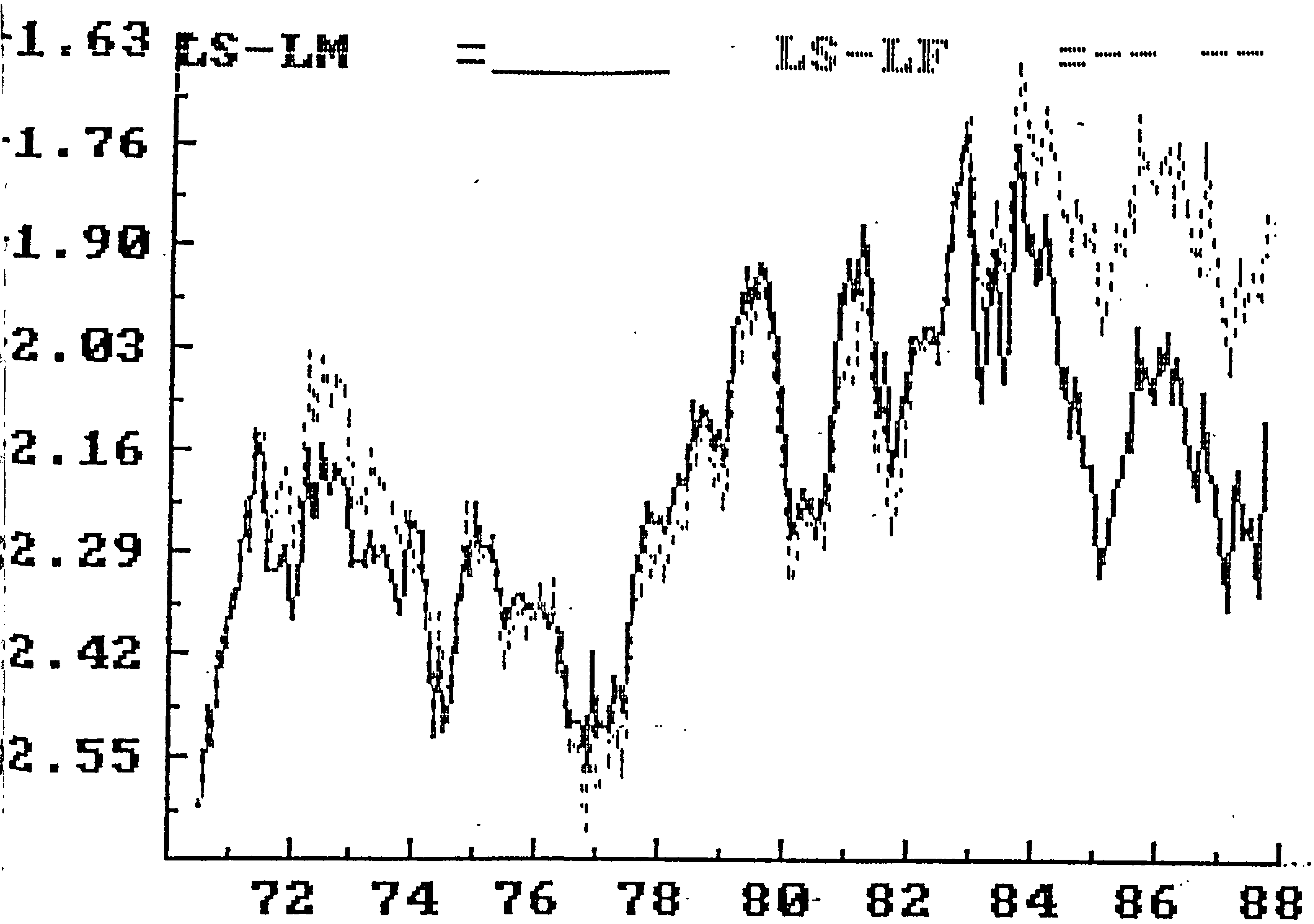



LLA-LL =
LLA-LF =
1.06
1.38
1.70
2.01
2.33
2.65
2.97
72 74 76 78 80 82 84 86 88
Sample Period is 1970(7) - 1987(10)

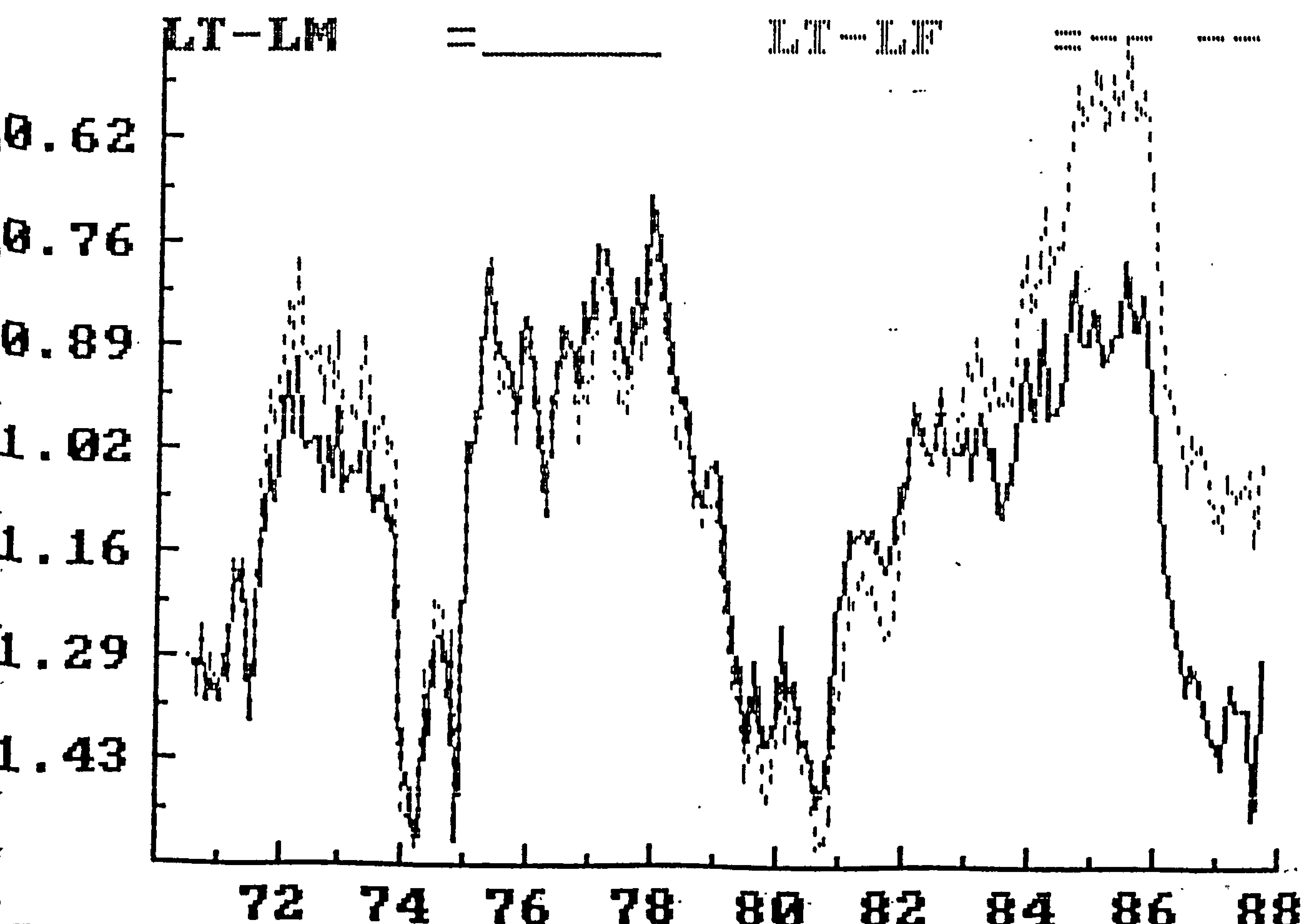

LT-LL =
LT-LF =
1.34
1.50
1.65
1.81
1.97
2.12
2.28
2.43
72 74 76 78 80 82 84 86 88



Sample Period is 1970(7) - 1987(10)



Sample Period is 1970(7) - 1987(10)



Sample Period is 1970(7) - 1987(10)

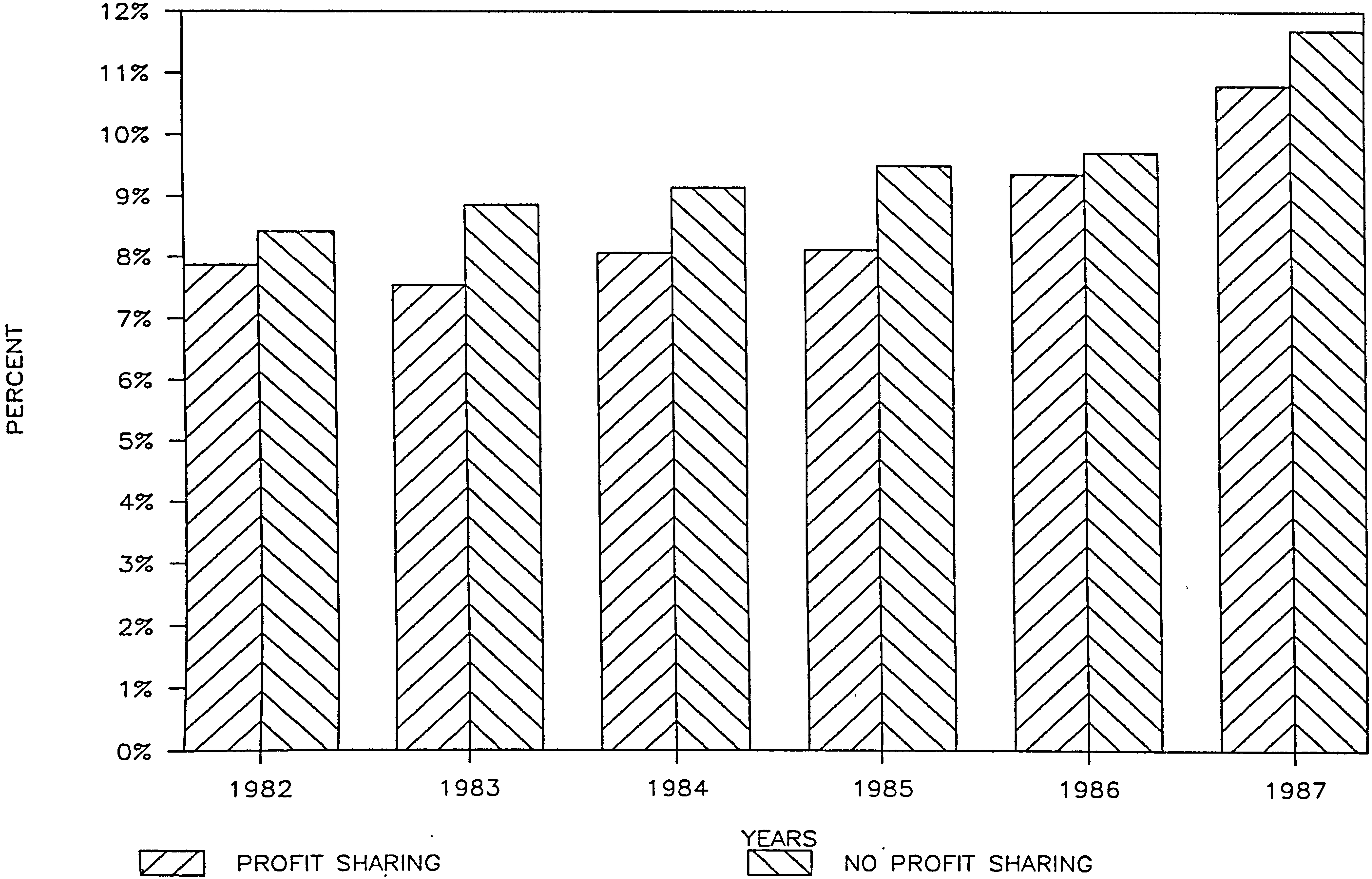
APPENDIX B

Characteristics and performance of companies with and without profit sharing schemes.

HIGHEST PAID DIRECTOR
47 of the TOP 100 U.K. COMPANIES
(Thousands)
400
350
300
250
200
150
100
50
0
1979
1980
1981
1982
1983
1984
1985
1986
1987
YEARS
PROFIT SHARING
NO PROFIT SHARING

OPERATING PROFIT (%)

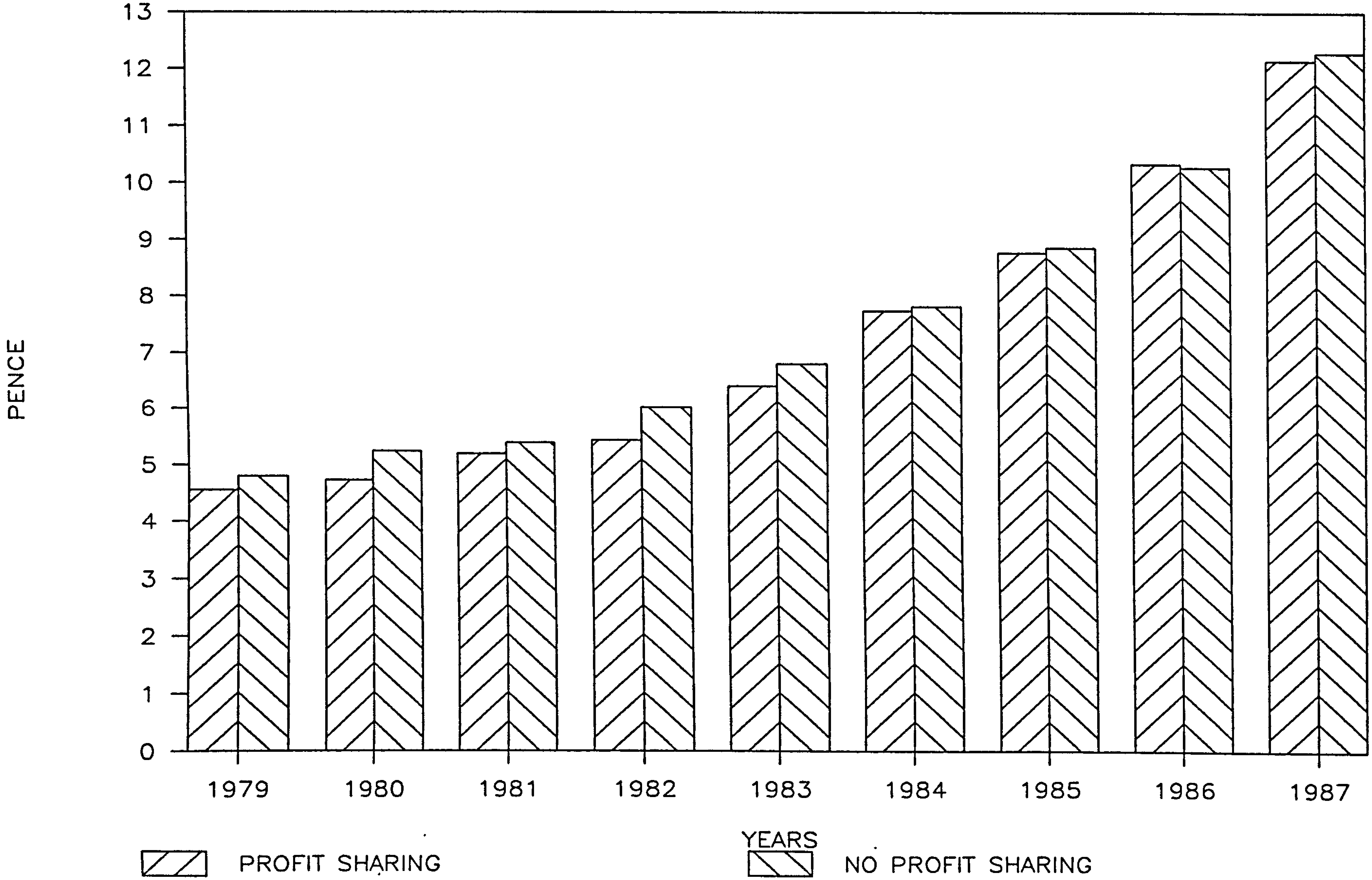
47 of the TOP 100 U.K. COMPANIES

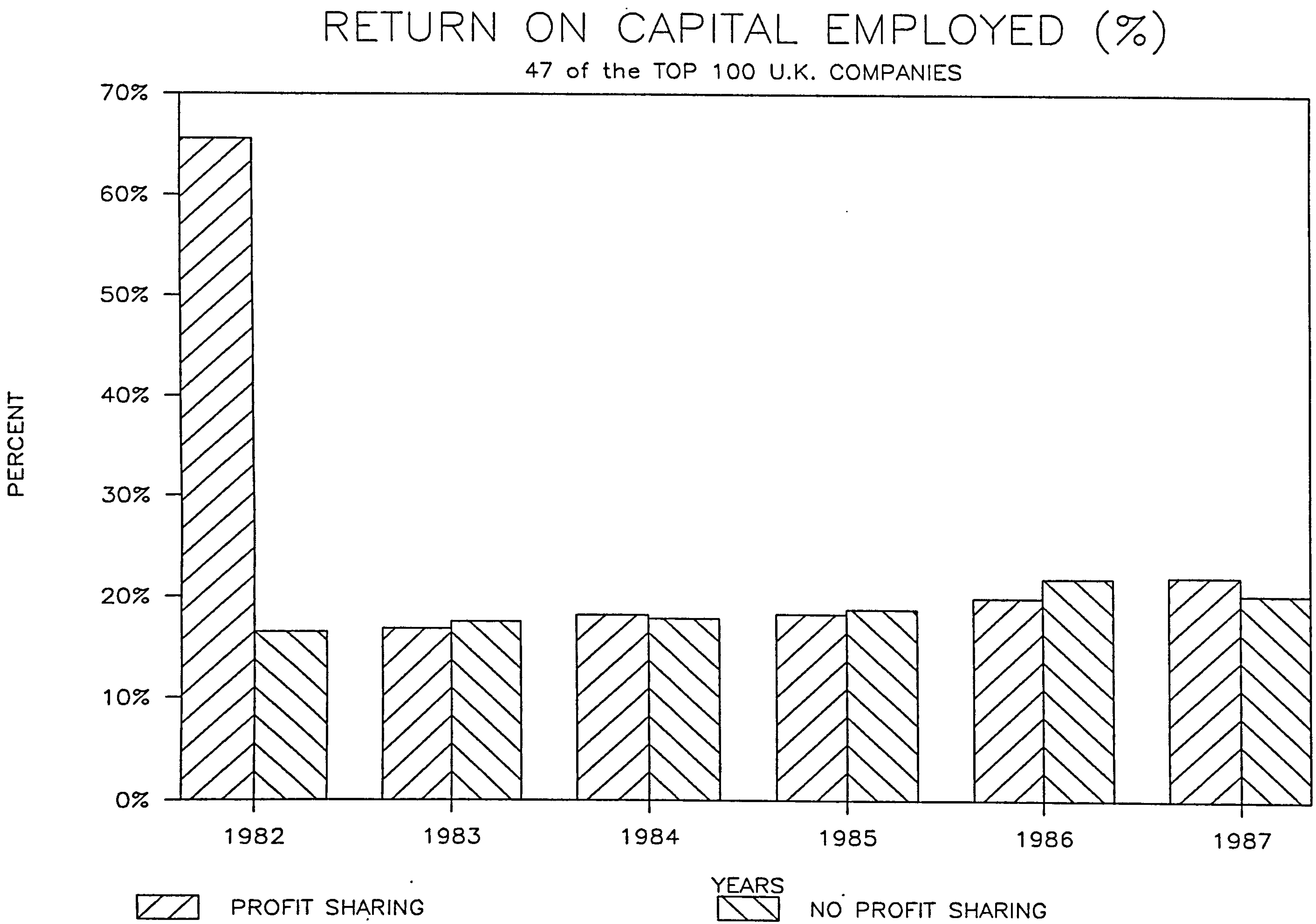


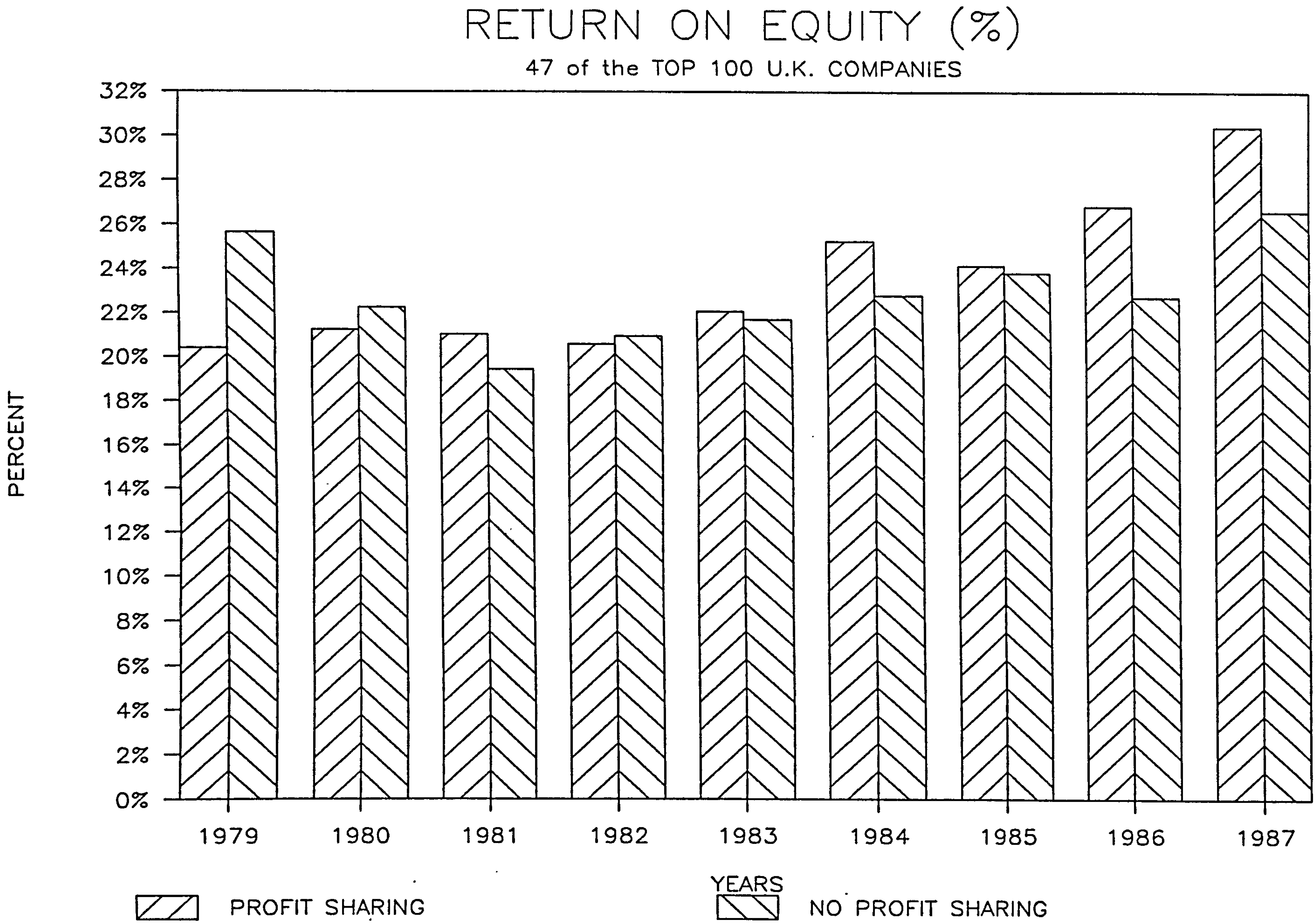
NET EARNINGS PER SHARE (pence)
47 of the TOP 100 U.K. COMPANIES
35
30
25
20
15
10
5
0
PENCE
1982
1983
1984
1985
1986
1987
YEARS
PROFIT SHARING
NO PROFIT SHARING

NET DIVIDENDS PER SHARE (pence)

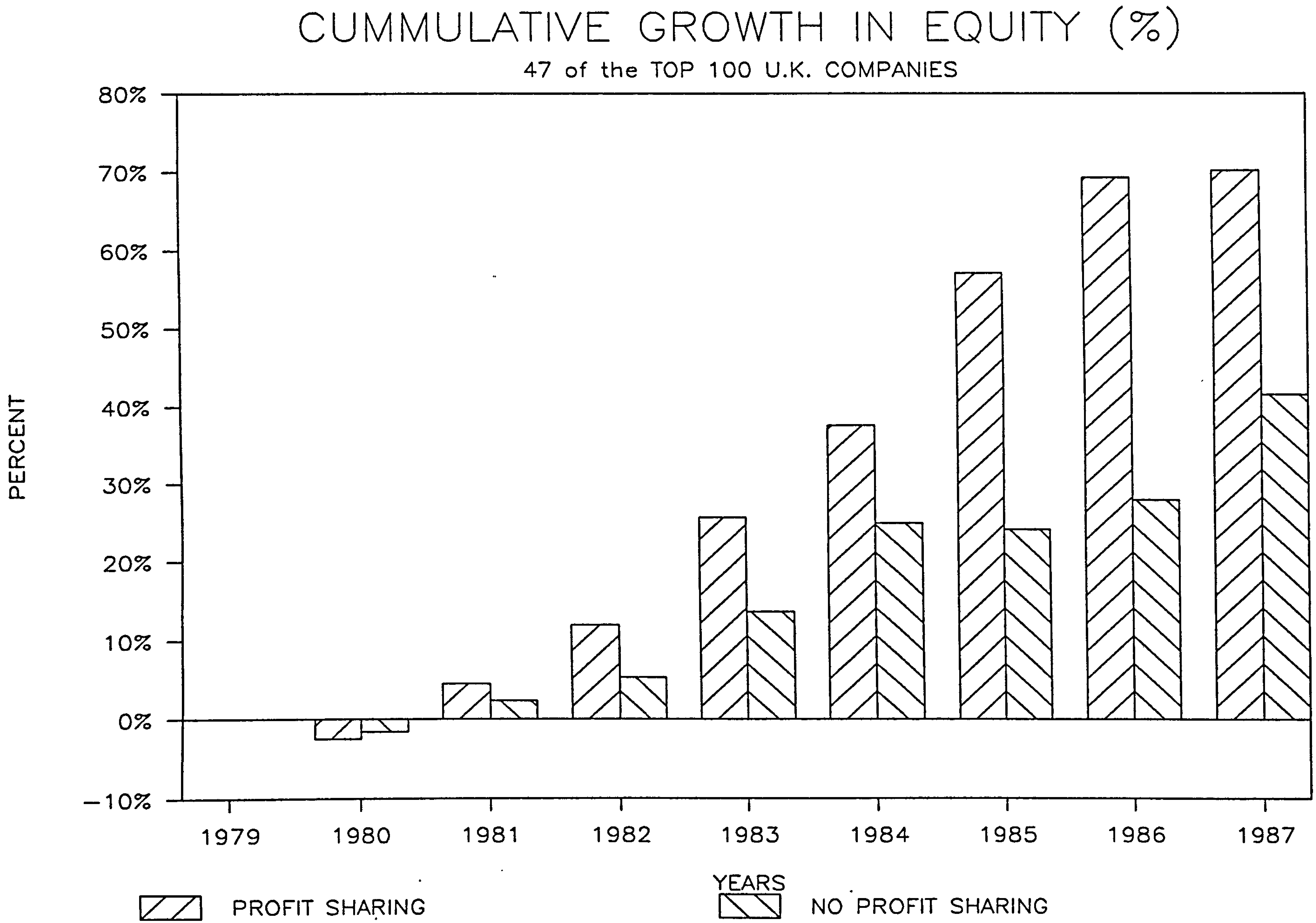
47 of the TOP 100 U.K. COMPANIES




RETURN ON CAPITAL EMPLOYED (%)
47 of the TOP 100 U.K. COMPANIES
PERCENT
70%
60%
50%
40%
30%
20%
10%
0%
1982
1983
1984
1985
1986
1987
YEARS
PROFIT SHARING
NO PROFIT SHARING

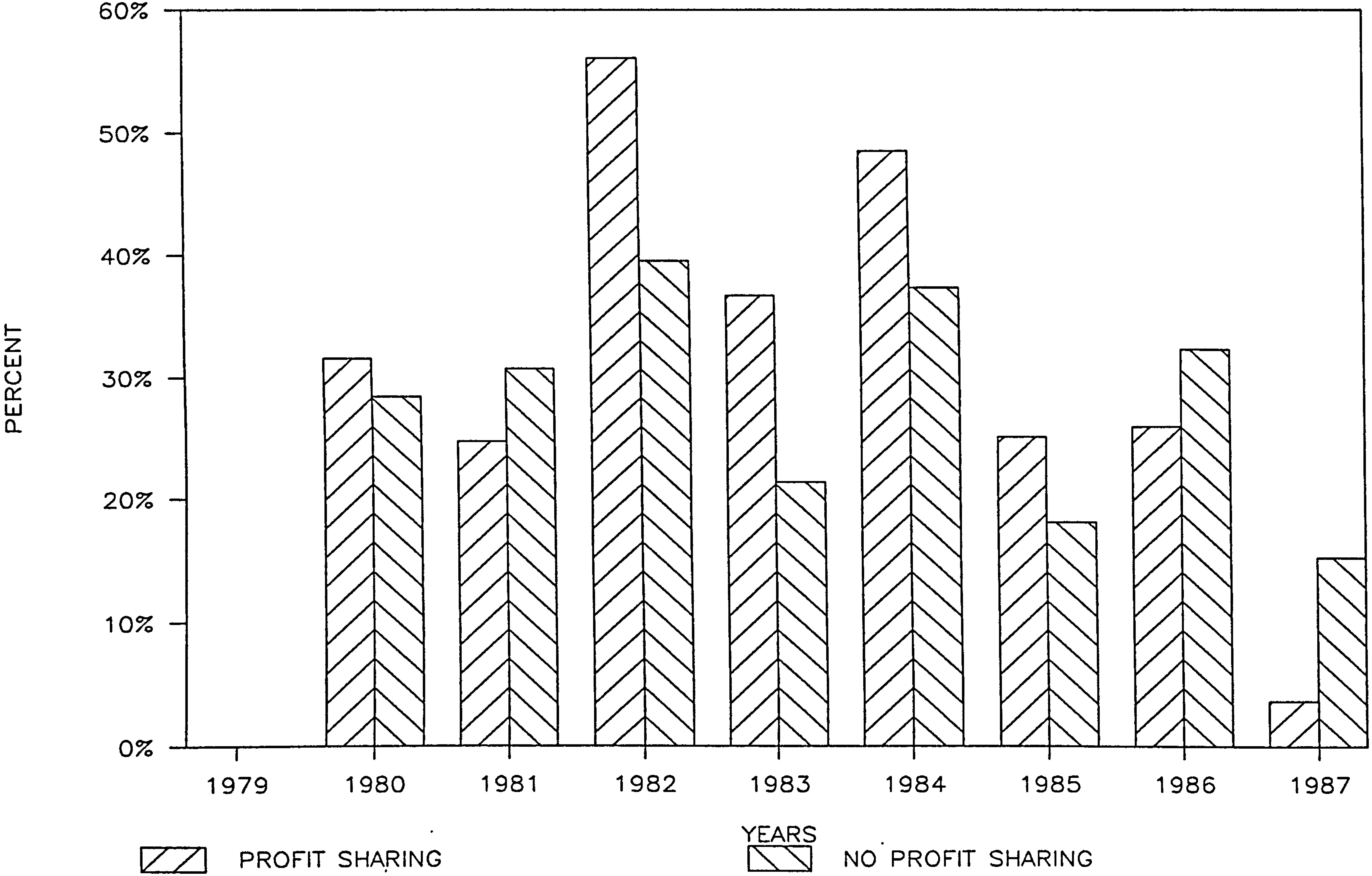

RETURN ON EQUITY (%)
47 of the TOP 100 U.K. COMPANIES
PERCENT
32%
30%
28%
26%
24%
22%
20%
18%
16%
14%
12%
10%
8%
6%
4%
2%
0%
1979
1980
1981
1982
1983
1984
1985
1986
1987
YEARS
PROFIT SHARING
NO PROFIT SHARING

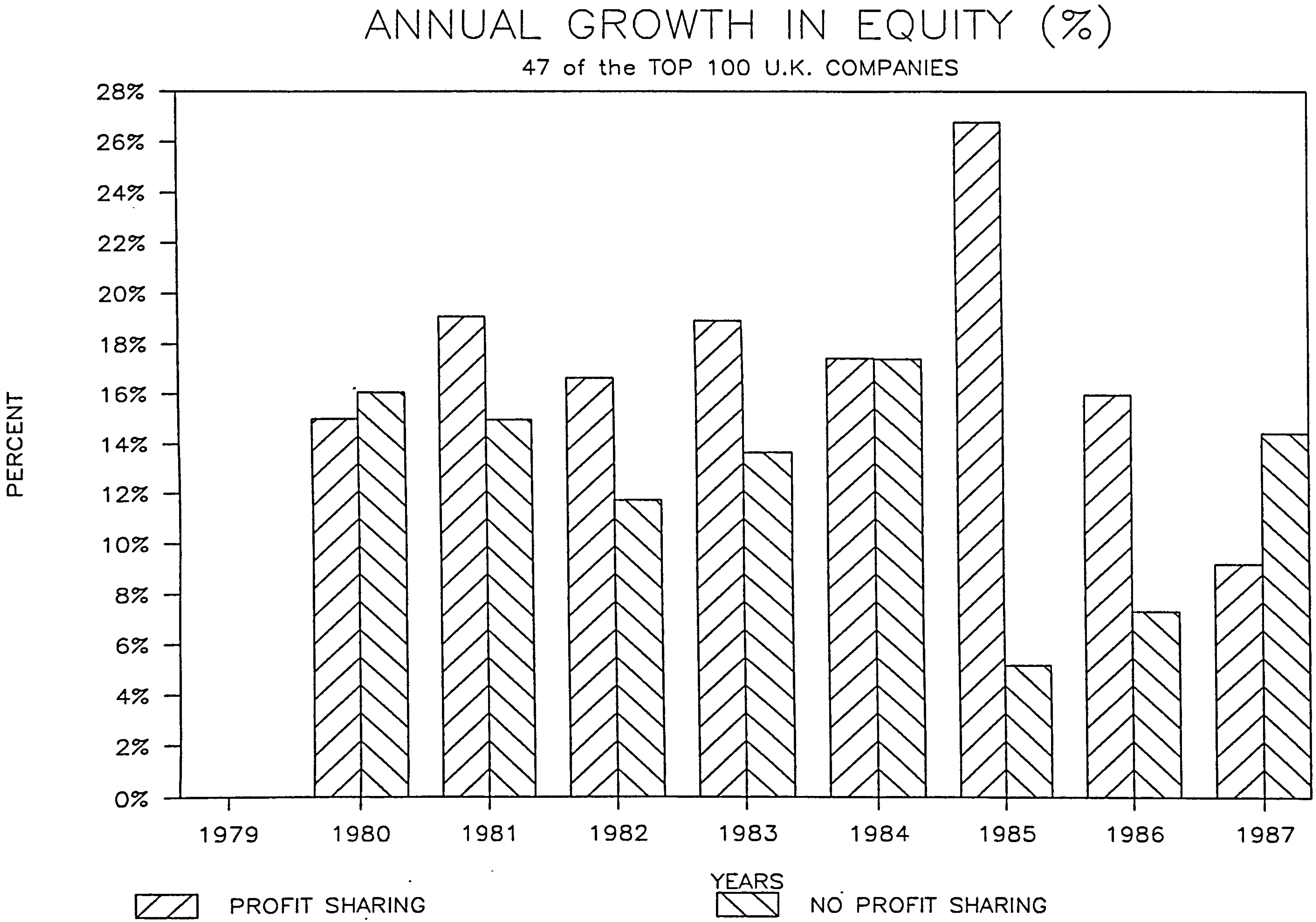
CUMMULATIVE GROWTH IN SALES (%)
47 of the TOP 100 U.K. COMPANIES
PERCENT
70%
60%
50%
40%
30%
20%
10%
0%
−10%
1979
1980
1981
1982
1983
1984
1985
1986
1987
YEARS
PROFIT SHARING
NO PROFIT SHARING


CUMMULATIVE GROWTH IN EQUITY (%)
47 of the TOP 100 U.K. COMPANIES
80%
70%
60%
50%
40%
30%
20%
10%
0%
−10%
PERCENT
1979
1980
1981
1982
1983
1984
1985
1986
1987
YEARS
PROFIT SHARING
NO PROFIT SHARING

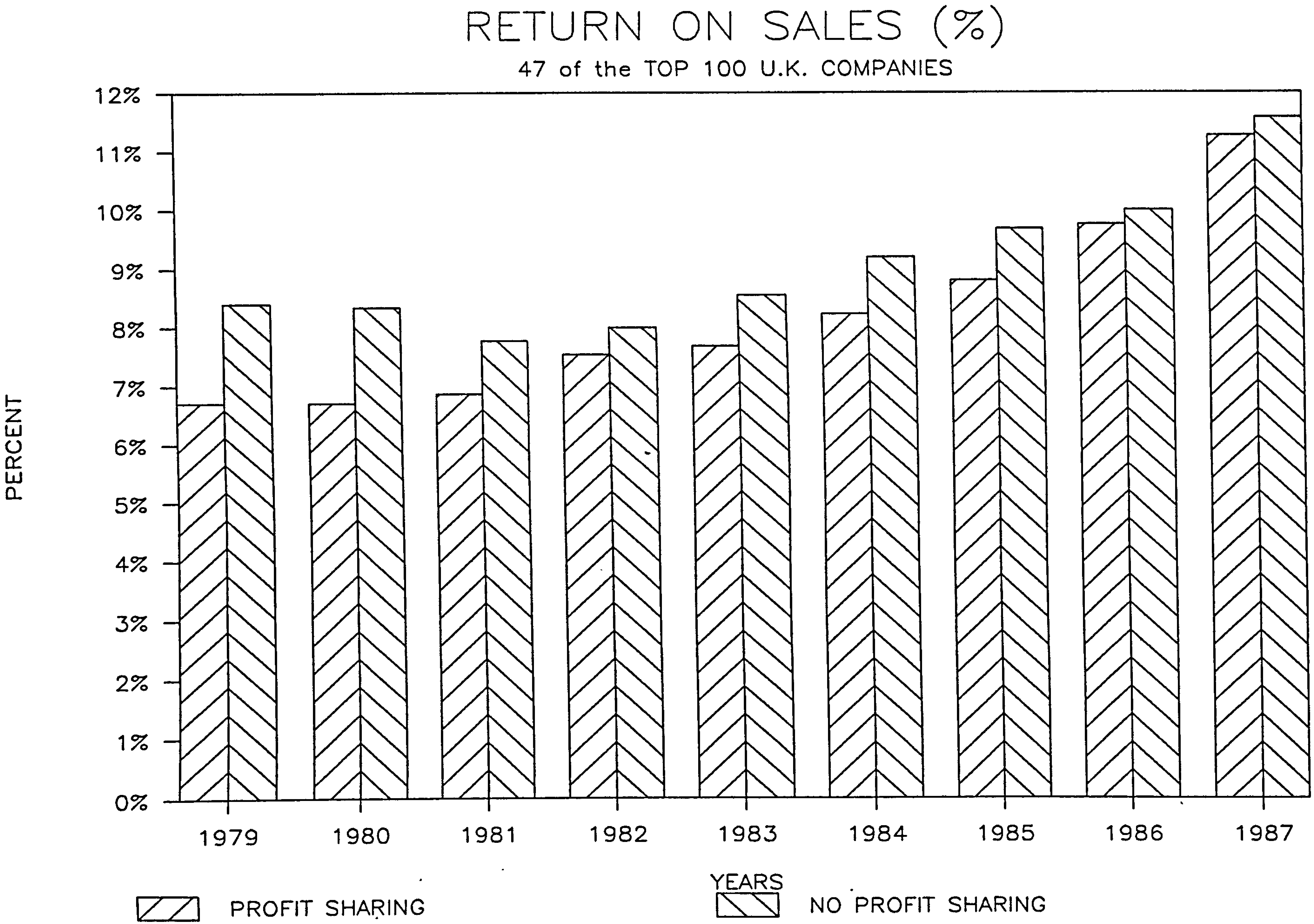
TOTAL ANNUAL INVESTOR RETURNS (%)

47 of the TOP 100 U.K. COMPANIES




ANNUAL GROWTH IN EQUITY (%)
47 of the TOP 100 U.K. COMPANIES
PERCENT
28%
26%
24%
22%
20%
18%
16%
14%
12%
10%
8%
6%
4%
2%
0%
1979
1980
1981
1982
1983
1984
1985
1986
1987
YEARS
PROFIT SHARING
NO PROFIT SHARING


ANNUAL GROWTH IN SALES (%)
47 of the TOP 100 U.K. COMPANIES
PERCENT
28%
26%
24%
22%
20%
18%
16%
14%
12%
10%
8%
6%
4%
2%
0%
1979
1980
1981
1982
1983
1984
1985
1986
1987
YEARS
PROFIT SHARING
NO PROFIT SHARING



RETURN ON SALES (%)
47 of the TOP 100 U.K. COMPANIES
PERCENT
12%
11%
10%
9%
8%
7%
6%
5%
4%
3%
2%
1%
0%
1979
1980
1981
1982
1983
1984
1985
1986
1987
YEARS
PROFIT SHARING
NO PROFIT SHARING

APPENDIX C

Accounting data for the fifty-two companies

PROFIT SCHEMES

	COMPANY NAME	YEAR	YEAR END	TURNOVER (m)	PRE-TAX PROFIT(000)	FUND (m)
D5	BOC GROUP	1979	SEP 79	1,229	63,303	514
D5	BOC GROUP	1980	SEP 80	1,194	61,500	580
D5	BOC GROUP	1981	SEP 81	1,523	92,700	785
D5	BOC GROUP	1982	SEP 82	1,534	112,100	888
D5	BOC GROUP	1983	SEP 83	1,702	114,800	1042
D5	BOC GROUP	1984	SEP 84	2,103	137,800	1204
D5	BOC GROUP	1985	SEP 85	1,901	171,300	1129
D5	BOC GROUP	1986	SEP 86	1,945	192,100	1035
D5	BOC GROUP	1987	SEP 87	1,959	263,200	982
D6	BTR	1979	DEC 79	433	59,650	149
D6	BTR	1980	JAN 81	510	70,258	221
D6	BTR	1981	JAN 82	638	90,154	216
D6	BTR	1982	JAN 83	725	106,661	317
D6	BTR	1983	DEC 83	1,970	170,600	692
D6	BTR	1984	DEC 84	3,487	284,200	847
D6	BTR	1985	DEC 85	3,881	361,800	1016
D6	BTR	1986	DEC 86	4,019	504,800	1251
D6	BTR	1987	DEC 87	4,150	590,300	1289
E7	BUNZL	1979	DEC 79	230	7,366	52
E7	BUNZL	1980	DEC 80	170	5,444	62
E7	BUNZL	1981	DEC 81	246	7,878	67
E7	BUNZL	1982	DEC 82	362	12,689	67
E7	BUNZL	1983	DEC 83	541	17,325	70
E7	BUNZL	1984	DEC 84	875	27,648	76
E7	BUNZL	1985	DEC 85	788	42,664	135
E7	BUNZL	1986	DEC 86	1,067	64,823	314
E7	BUNZL	1987	DEC 87	1,471	86,000	
G6	BURTON GROUP	1979	SEP 79	165	12,337	142
G6	BURTON GROUP	1980	AUG 80	226	16,897	126
G6	BURTON GROUP	1981	AUG 81	219	16,374	139
G6	BURTON GROUP	1982	AUG 82	203	24,263	216
G6	BURTON GROUP	1983	AUG 83	299	38,817	239
G6	BURTON GROUP	1984	AUG 84	417	56,028	261
G6	BURTON GROUP	1985	AUG 85	551	79,415	369
G6	BURTON GROUP	1986	AUG 86	1,229	148,500	441
G6	BURTON GROUP	1987	AUG 87	1,339	182,500	523
H3	CADBURY SCHWEPPS	1979	DEC 79	1,006	55,110	273
H3	CADBURY SCHWEPPS	1980	JAN 81	1,119	61,300	292
H3	CADBURY SCHWEPPS	1981	JAN 82	1,271	80,600	384
H3	CADBURY SCHWEPPS	1982	JAN 83	1,578	89,700	389
H3	CADBURY SCHWEPPS	1983	DEC 83	1,703	106,900	397
H3	CADBURY SCHWEPPS	1984	DEC 84	2,016	124,000	515
H3	CADBURY SCHWEPPS	1985	DEC 85	1,874	93,300	468
H3	CADBURY SCHWEPPS	1986	JAN 87	1,840	130,700	460
H3	CADBURY SCHWEPPS	1987	JAN 88	2,031	176,100	473
G6	DIXONS	1979	APR 79	208	10,890	46
G6	DIXONS	1980	APR 80	219	11,466	55
G6	DIXONS	1981	MAY 81	230	12,042	60
G6	DIXONS	1982	MAY 82	251	13,141	70
G6	DIXONS	1983	APR 83	268	13,974	84
G6	DIXONS	1984	APR 84	351	20,553	113
G6	DIXONS	1985	APR 85	607	39,600	145

COMPANY NAME	YEAR	YEAR END	TURNOVER (m)	PRE-TAX PROFIT(000)	FUND (m)
G6 DIXONS	1986	APR 86	943	78,100	172
G6 DIXONS	1987	APR 87	1,111	102,600	230
D5 FISONS	1979	DEC 79	433	3,656	164
D5 FISONS	1980	DEC 80	454	3,833	146
D5 FISONS	1981	DEC 81	494	9,246	131
D5 FISONS	1982	DEC 82	235	20,952	137
D5 FISONS	1983	DEC 83	279	31,300	172
D5 FISONS	1984	DEC 84	506	48,300	181
D5 FISONS	1985	DEC 85	601	72,300	291
D5 FISONS	1986	DEC 86	664	85,100	305
D5 FISONS	1987	DEC 87	720	100,800	329
F1 GRANADA GROUP	1979	SEP 79	278	23,158	122
F1 GRANADA GROUP	1980	SEP 80	331	27,573	118
F1 GRANADA GROUP	1981	SEP 81	385	32,071	148
F1 GRANADA GROUP	1982	SEP 82	460	38,319	161
F1 GRANADA GROUP	1983	SEP 83	521	43,400	177
F1 GRANADA GROUP	1984	SEP 84	630	53,754	264
F1 GRANADA GROUP	1985	SEP 85	762	64,618	262
F1 GRANADA GROUP	1986	SEP 86	836	92,431	361
F1 GRANADA GROUP	1987	SEP 87	1,014	111,100	405
F2 GRAND METROPLTN	1979	SEP 79	2,171	127,839	890
F2 GRAND METROPLTN	1980	SEP 80	2,583	152,100	1238
F2 GRAND METROPLTN	1981	SEP 81	3,221	186,600	1213
F2 GRAND METROPLTN	1982	SEP 82	3,849	220,200	1421
F2 GRAND METROPLTN	1983	SEP 83	4,469	295,400	1554
F2 GRAND METROPLTN	1984	SEP 84	5,075	334,300	1731
F2 GRAND METROPLTN	1985	SEP 85	5,590	347,300	1952
F2 GRAND METROPLTN	1986	SEP 86	5,291	383,200	2033
F2 GRAND METROPLTN	1987	SEP 87	5,706	451,700	1725
I1 HANSON TRUST	1979	SEP 79	658	37,614	107
I1 HANSON TRUST	1980	SEP 80	684	39,100	121
I1 HANSON TRUST	1981	SEP 81	856	49,700	165
I1 HANSON TRUST	1982	SEP 82	1,148	60,400	189
I1 HANSON TRUST	1983	SEP 83	1,484	91,100	429
I1 HANSON TRUST	1984	SEP 84	2,382	169,100	410
I1 HANSON TRUST	1985	SEP 85	2,675	252,800	976
I1 HANSON TRUST	1986	SEP 86	4,312	464,000	1439
I1 HANSON TRUST	1987	SEP 87	6,682	741,000	1730
D5 IMP. CHEM.INDS	1979	DEC 79	5,368	266,756	2798
D5 IMP. CHEM.INDS	1980	DEC 80	5,715	284,000	3010
D5 IMP. CHEM.INDS	1981	DEC 81	6,581	335,000	2955
D5 IMP. CHEM.INDS	1982	DEC 82	7,358	270,000	3249
D5 IMP. CHEM.INDS	1983	DEC 83	8,256	612,000	3531
D5 IMP. CHEM.INDS	1984	DEC 84	9,909	1,037,000	4016
D5 IMP. CHEM.INDS	1985	DEC 85	10,725	904,000	3684
D5 IMP. CHEM.INDS	1986	DEC 86	10,136	1,005,000	3848
D5 IMP. CHEM.INDS	1987	DEC 87	11,123	1,302,000	3584
F3 LADBROKE GROUP	1979	JAN 80	579	28,384	128
F3 LADBROKE GROUP	1980	DEC 80	665	32,600	146
F3 LADBROKE GROUP	1981	DEC 81	702	32,800	190
F3 LADBROKE GROUP	1982	DEC 82	701	31,400	208
F3 LADBROKE GROUP	1983	JAN 84	788	41,400	219

	COMPANY NAME	YEAR	YEAR END	TURNOVER (m)	PRE-TAX PROFIT(000)	FUND (m)
F3	LADBROKE GROUP	1984	JAN 85	1,045	50,200	330
F3	LADBROKE GROUP	1985	DEC 85	1,256	75,100	546
F3	LADBROKE GROUP	1986	DEC 86	1,664	101,300	699
F3	LADBROKE GROUP	1987	DEC 87	2,130	160,200	
G6	MARKS & SPENCER	1979	MAR 79	1,098	106,199	
G6	MARKS & SPENCER	1980	MAR 80	1,668	161,368	548
G6	MARKS & SPENCER	1981	MAR 81	1,873	181,200	598
G6	MARKS & SPENCER	1982	MAR 82	2,199	222,100	1064
G6	MARKS & SPENCER	1983	MAR 83	2,506	237,400	1143
G6	MARKS & SPENCER	1984	MAR 84	2,855	280,700	1225
G6	MARKS & SPENCER	1985	MAR 85	3,194	303,100	1324
G6	MARKS & SPENCER	1986	MAR 86	3,716	364,400	1451
G6	MARKS & SPENCER	1987	MAR 87	4,221	425,400	1577
I1	PERSONS	1979	DEC 79	484	30,029	195
I1	PERSONS	1980	DEC 80	591	36,668	237
I1	PERSONS	1981	DEC 81	702	59,551	270
I1	PERSONS	1982	DEC 82	719	59,858	318
I1	PERSONS	1983	DEC 83	730	77,353	334
I1	PERSONS	1984	DEC 84	843	99,443	395
I1	PERSONS	1985	DEC 85	970	109,300	389
I1	PERSONS	1986	DEC 86	953	121,100	444
I1	PERSONS	1987	DEC 87	952	151,800	594
B1	PLESSEY	1979	MAR 79	567	56,711	248
B1	PLESSEY	1980	MAR 80	751	75,133	298
B1	PLESSEY	1981	APR 81	845	84,537	360
B1	PLESSEY	1982	APR 82	963	111,438	408
B1	PLESSEY	1983	APR 83	1,075	146,648	411
B1	PLESSEY	1984	MAR 84	1,219	176,112	495
B1	PLESSEY	1985	MAR 85	1,416	162,335	533
B1	PLESSEY	1986	MAR 86	1,461	169,800	533
B1	PLESSEY	1987	APR 87	1,430	183,200	608
B2	RANK ORG.	1979	OCT 79	538	100,244	469
B2	RANK ORG.	1980	OCT 80	597	111,237	513
B2	RANK ORG.	1981	OCT 81	618	102,756	567
B2	RANK ORG.	1982	OCT 82	675	60,373	534
B2	RANK ORG.	1983	OCT 83	742	62,700	530
B2	RANK ORG.	1984	OCT 84	722	87,900	526
B2	RANK ORG.	1985	OCT 85	631	127,500	528
B2	RANK ORG.	1986	OCT 86	718	160,400	562
B2	RANK ORG.	1987	OCT 87	668	200,700	610
A1	REDLAND	1979	MAR 79	420	38,132	
A1	REDLAND	1980	MAR 80	495	44,944	122
A1	REDLAND	1981	MAR 81	515	46,760	135
A1	REDLAND	1982	MAR 82	572	43,510	163
A1	REDLAND	1983	MAR 83	799	60,000	245
A1	REDLAND	1984	MAR 84	915	93,900	236
A1	REDLAND	1985	MAR 85	955	103,500	286
A1	REDLAND	1986	MAR 86	921	105,600	305
A1	REDLAND	1987	MAR 87	979	130,600	499
H4	REED INTL.	1979	MAR 79	1,387	47,232	
I1	REED INTL.	1980	MAR 80	1,516	51,626	491
I1	REED INTL.	1981	MAR 81	1,480	50,400	631

	COMPANY NAME	YEAR	YEAR END	TURNOVER (m)	PRE-TAX PROFIT(000)	FUND (m)
I1	REED INTL.	1982	APR 82	1,699	71,600	669
I1	REED INTL.	1983	MAR 83	1,809	74,100	593
I1	REED INTL.	1984	APR 84	2,043	105,600	642
I1	REED INTL.	1985	MAR 85	2,115	112,200	645
I1	REED INTL.	1986	MAR 86	1,931	149,800	626
I1	REED INTL.	1987	MAR 87	1,950	187,700	690
D8	SHELL TRANSPORT	1979	DEC 79	-22,706	1,662,999	4181
D8	SHELL TRANSPORT	1980	DEC 80	34,257	2,509,000	4814
D8	SHELL TRANSPORT	1981	DEC 81	41,569	2,638,000	5295
D8	SHELL TRANSPORT	1982	DEC 82	19,151	2,945,000	6781
D8	SHELL TRANSPORT	1983	DEC 83	24,838	3,020,200	7843
D8	SHELL TRANSPORT	1984	DEC 84	29,522	3,495,500	10211
D8	SHELL TRANSPORT	1985	DEC 85	29,241	3,208,000	9390
D8	SHELL TRANSPORT	1986	DEC 86	22,219	2,107,900	10025
D8	SHELL TRANSPORT	1987	DEC 87	23,924	2,184,400	9195
A4	TARMAC	1979	DEC 79	836	41,629	126
A4	TARMAC	1980	DEC 80	884	44,019	161
A4	TARMAC	1981	DEC 81	918	52,131	203
A4	TARMAC	1982	DEC 82	988	68,700	232
A4	TARMAC	1983	DEC 83	1,124	87,700	253
A4	TARMAC	1984	DEC 84	1,277	105,100	333
A4	TARMAC	1985	DEC 85	1,536	122,900	427
A4	TARMAC	1986	DEC 86	1,718	161,900	491
A4	TARMAC	1987	DEC 87	2,201	265,400	
G2	TESCO	1979	FEB 80	1,531	25,922	197
G2	TESCO	1980	FEB 81	1,916	32,441	238
G2	TESCO	1981	FEB 82	2,102	35,590	282
G2	TESCO	1982	FEB 83	2,404	42,700	321
G2	TESCO	1983	FEB 84	2,277	53,500	335
G2	TESCO	1984	FEB 85	2,595	67,400	380
G2	TESCO	1985	FEB 86	3,000	81,504	589
G2	TESCO	1986	FEB 87	3,355	122,900	690
G2	TESCO	1987	FEB 88	3,593	166,500	
I1	TRAFALGAR HOUSE	1979	SEPT 79	946	43,726	
I1	TRAFALGAR HOUSE	1980	SEPT 80	1,066	49,272	168
I1	TRAFALGAR HOUSE	1981	SEPT 81	1,190	55,004	183
I1	TRAFALGAR HOUSE	1982	SEPT 82	913	64,812	227
I1	TRAFALGAR HOUSE	1983	SEPT 83	1,191	78,511	260
I1	TRAFALGAR HOUSE	1984	SEPT 84	1,337	103,410	326
I1	TRAFALGAR HOUSE	1985	SEPT 85	1,649	124,873	503
I1	TRAFALGAR HOUSE	1986	SEPT 86	1,739	120,100	414
I1	TRAFALGAR HOUSE	1987	SEPT 87	2,138	148,200	731
H5	UNITED BISCUITS	1979	DEC 79	633	38,261	
H5	UNITED BISCUITS	1980	DEC 80	791	47,800	194
H5	UNITED BISCUITS	1981	JAN 81	880	60,900	300
H5	UNITED BISCUITS	1982	JAN 83	1,205	68,400	264
H5	UNITED BISCUITS	1983	DEC 83	1,425	83,200	258
H5	UNITED BISCUITS	1984	DEC 83	1,660	87,200	301
H5	UNITED BISCUITS	1985	DEC 85	1,806	102,200	414
H5	UNITED BISCUITS	1986	JAN 87	1,818	125,260	453
H5	UNITED BISCUITS	1987	JAN 88	1,832	147,000	490
H1	WHITBREAD A	1979	MAR 79	604	51,270	

	COMPANY NAME	YEAR	YEAR END	TURNOVER (m)	PRE-TAX PROFIT(000)	FUND (m)
H1	WHITBREAD A	1980	MAR 80	738	62,653	431
H1	WHITBREAD A	1981	FEB 81	782	66,388	761
H1	WHITBREAD A	1982	FEB 82	842	73,188	789
H1	WHITBREAD A	1983	FEB 83	1,002	80,000	810
H1	WHITBREAD A	1984	MAR 84	1,186	93,800	850
H1	WHITBREAD A	1985	MAR 85	1,444	108,800	1016
H1	WHITBREAD A	1986	MAR 86	1,533	127,500	1088
H1	WHITBREAD A	1987	FEB 87	1,554	148,500	1159

COMPANY NAME	ROCE	OPERATING PROFIT	EMPLOYEES	HPD	MARKET VALUE (m)
D5 BOC GROUP			50,200	62,700	18,487
D5 BOC GROUP			40,700	271,400	34,244
D5 BOC GROUP			43,300	477,100	50,055
D5 BOC GROUP	0.105	0.104	40,420	579,000	66,759
D5 BOC GROUP	0.090	0.093	39,540	521,500	115,013
D5 BOC GROUP	0.101	0.097	38,690	771,600	100,505
D5 BOC GROUP	0.121	0.121	36,858	883,100	124,734
D5 BOC GROUP	0.142	0.119		772,800	166,994
D5 BOC GROUP	0.185	0.150		782,300	172,813
D6 BTR			15,131	47,000	30,064
D6 BTR			13,807	55,000	58,663
D6 BTR			12,350	66,000	81,935
D6 BTR	0.253	0.164	12,829	80,000	90,879
D6 BTR	0.148	0.105	62,500	97,000	226,239
D6 BTR	0.225	0.097	60,300	142,000	326,066
D6 BTR	0.229	0.019	85,400	197,000	411,278
D6 BTR	0.278	0.131		260,000	454,028
D6 BTR	0.303	0.140		225,000	464,155
E7 BUNZL			6,727	45,000	2,697
E7 BUNZL			2,629	52,000	29
E7 BUNZL			3,881	62,000	40
E7 BUNZL	0.150	0.030	4,116	73,000	59
E7 BUNZL	0.200	0.034	4,362	96,000	113
E7 BUNZL	0.265	0.037	4,892	112,500	260
E7 BUNZL	0.199	0.052	5,720	115,500	494
E7 BUNZL	0.155	0.059		281,275	842
E7 BUNZL				354,226	649
G6 BURTON GROUP			11,132	58,000	7,674
G6 BURTON GROUP			12,852	88,000	7,310
G6 BURTON GROUP			10,863	101,000	10,601
G6 BURTON GROUP	0.112	0.120	9,473	126,000	25,093
G6 BURTON GROUP	0.158	0.126	10,014	199,000	36,646
G6 BURTON GROUP	0.201	0.133	12,160	348,000	74,475
G6 BURTON GROUP	0.110	0.148	14,739	542,000	149,984
G6 BURTON GROUP	0.260	0.128		1,004,000	155,876
G6 BURTON GROUP	0.247	0.117		1,359,000	122,335
H3 CADBURY SCHWEPPS			41,155	54,474	20,188
H3 CADBURY SCHWEPPS			39,561	62,971	26,182
H3 CADBURY SCHWEPPS			36,463	77,906	38,182
H3 CADBURY SCHWEPPS	0.175	0.066	38,148	126,090	51,965
H3 CADBURY SCHWEPPS	0.186	0.074	37,140	127,031	52,443
H3 CADBURY SCHWEPPS	0.199	0.077	35,455	120,578	82,278
H3 CADBURY SCHWEPPS	0.170	0.060	33,787	113,117	81,901
H3 CADBURY SCHWEPPS	0.203	0.076		157,494	103,844
H3 CADBURY SCHWEPPS	0.243	0.089		184,358	134,327
G6 DIXONS			4,877	34,289	4,626
G6 DIXONS			4,416	46,790	6,387
G6 DIXONS			3,747	54,339	8,449
G6 DIXONS			3,696	83,325	12,070
G6 DIXONS	0.159	0.042	3,402	95,565	14,969
G6 DIXONS	0.143	0.050	4,221	121,263	37,029
G6 DIXONS	0.139	0.055	7,581	208,334	85,001

COMPANY NAME	ROCE	OPERATING PROFIT	EMPLOYEES	HPD	MARKET VALUE (m)
G6 DIXONS	0.330	0.085		487,654	118,720
G6 DIXONS	0.330	0.089		659,000	77,162
D5 FISONS			13,245	64,392	9,733
D5 FISONS			11,304	72,984	7,246
D5 FISONS			9,839	75,549	5,890
D5 FISONS	0.153	0.110	7,539	91,398	15,976
D5 FISONS	0.169	0.111	7,495	111,773	32,784
D5 FISONS	0.202	0.100	8,634	131,362	59,252
D5 FISONS	0.209	0.107	9,021	164,395	106,514
D5 FISONS	0.207	0.116		189,174	130,200
D5 FISONS	0.247	0.131		253,181	121,351
F1 GRANADA GROUP			11,427	36,584	19,811
F1 GRANADA GROUP			12,058	44,678	27,690
F1 GRANADA GROUP			12,163	44,908	33,128
F1 GRANADA GROUP			11,736	55,000	30,931
F1 GRANADA GROUP			13,975	61,000	28,776
F1 GRANADA GROUP	0.131	0.095	15,556	72,000	47,926
F1 GRANADA GROUP	0.166	0.088	18,916	91,000	52,044
F1 GRANADA GROUP	0.182	0.123		155,000	73,562
F1 GRANADA GROUP	0.196	0.121		168,000	81,314
F2 GRAND METROPLTN			118,735	50,380	64,988
F2 GRAND METROPLTN			126,737	54,167	78,530
F2 GRAND METROPLTN			131,757	67,770	98,026
F2 GRAND METROPLTN	0.157	0.088	129,454	82,578	200,198
F2 GRAND METROPLTN	0.160	0.088	136,297	111,138	198,749
F2 GRAND METROPLTN	0.153	0.086	125,074	144,284	229,853
F2 GRAND METROPLTN	0.145	0.079	137,195	176,289	306,741
F2 GRAND METROPLTN	0.160	0.091		176,504	388,624
F2 GRAND METROPLTN	0.177	0.099		208,504	384,087
I1 HANSON TRUST			36,000	36,000	13,171
I1 HANSON TRUST			36,000	66,000	22,424
I1 HANSON TRUST			39,000	69,000	31,371
I1 HANSON TRUST	0.193	0.068	44,000	87,000	59,764
I1 HANSON TRUST	0.147	0.072	50,000	140,000	110,622
I1 HANSON TRUST	0.163	0.085	67,000	177,000	227,521
I1 HANSON TRUST	0.158	0.107	64,000	301,000	279,378
I1 HANSON TRUST	0.133	0.097		327,000	503,629
I1 HANSON TRUST	0.209	0.096		1,260,000	454,406
D5 IMP. CHEM.INDS			148,200	124,380	206,028
D5 IMP. CHEM.INDS			143,200	134,853	192,200
D5 IMP. CHEM.INDS			132,400	164,682	173,397
D5 IMP. CHEM.INDS	8.410	0.046	123,800	150,575	217,242
D5 IMP. CHEM.INDS	0.133	0.081	117,900	170,999	388,947
D5 IMP. CHEM.INDS	0.180	0.105	115,600	287,261	455,470
D5 IMP. CHEM.INDS	0.176	0.089	118,600	312,991	491,283
D5 IMP. CHEM.INDS	0.183	0.100		393,068	693,064
D5 IMP. CHEM.INDS	0.238	0.114		283,283	729,820
F3 LADBROKE GROUP			195,220	37,000	77
F3 LADBROKE GROUP			17,970	45,000	142
F3 LADBROKE GROUP			16,955	52,000	185
F3 LADBROKE GROUP	0.108	0.048	16,500	59,000	240
F3 LADBROKE GROUP	0.120	0.051	16,090	97,000	300

COMPANY NAME	ROCE	OPERATING PROFIT	EMPLOYEES	HPD	MARKET VALUE (m)
F3 LADBROKE GROUP	0.108	0.043	18,479	107,000	461
F3 LADBROKE GROUP	0.116	0.056	21,182	130,000	655
F3 LADBROKE GROUP	0.119	0.064	24,994	145,000	1,033
F3 LADBROKE GROUP			32,167	281,000	1,351
G6 MARKS & SPENCER				42,170	1,001
G6 MARKS & SPENCER			44,969	64,077	1,527
G6 MARKS & SPENCER			44,646	78,331	1,655
G6 MARKS & SPENCER			45,703	93,525	2,903
G6 MARKS & SPENCER	0.191	0.090	54,136	119,721	2,830
G6 MARKS & SPENCER	0.210	0.092	56,891	158,508	3,166
G6 MARKS & SPENCER	0.222	0.091	60,252	178,952	4,656
G6 MARKS & SPENCER	0.253	0.093	63,144	217,016	4,803
G6 MARKS & SPENCER	0.276	0.099		287,234	4,868
I1 PERSONS			34,553	62,805	133
I1 PERSONS			35,564	88,723	141
I1 PERSONS			34,223	103,445	149
I1 PERSONS	0.156	0.092	31,598	99,219	251
I1 PERSONS	0.171	0.094	27,567	200,672	382
I1 PERSONS	0.187	0.102	27,872	187,000	550
I1 PERSONS	0.209	0.102	30,158	170,000	862
I1 PERSONS	0.196	0.097	27,811	176,000	1,269
I1 PERSONS	0.206	0.117	23,250	283,000	1,486
B1 PLESSEY			38,006	101,101	240
B1 PLESSEY			35,922	133,944	585
B1 PLESSEY			33,026	139,937	1,315
B1 PLESSEY			40,872	188,200	2,206
B1 PLESSEY	0.273	0.110	38,838	233,128	1,651
B1 PLESSEY	0.268	0.119	37,533	248,365	1,536
B1 PLESSEY	0.223	0.099	34,366	220,919	1,248
B1 PLESSEY	0.216	0.104		218,334	1,358
B1 PLESSEY	0.220	0.110		237,347	1,063
B2 RANK ORG.			36,297	52,000	358
B2 RANK ORG.			35,933	61,000	347
B2 RANK ORG.			31,578	69,000	368
B2 RANK ORG.	0.125	0.043	28,112	73,000	214
B2 RANK ORG.	0.113	0.025	24,104	80,000	374
B2 RANK ORG.	0.157	0.039	20,616	131,000	598
B2 RANK ORG.	0.197	0.090	19,046	152,000	883
B2 RANK ORG.	0.202	0.109		152,000	1,127
B2 RANK ORG.	0.247	0.133		166,000	1,198
A1 REDLAND				52,895	170
A1 REDLAND			7,030	62,344	201
A1 REDLAND			6,519	70,628	189
A1 REDLAND			5,174	78,982	492
A1 REDLAND	0.155	0.058	11,514	83,232	536
A1 REDLAND	0.226	0.082		100,000	637
A1 REDLAND	0.226	0.089		120,311	735
A1 REDLAND	0.208	0.094	12,041	125,426	1,085
A1 REDLAND	0.167	0.122		131,375	1,091
H4 REED INTL.				68,808	192
I1 REED INTL.			61,100	75,209	210
I1 REED INTL.			58,200	87,957	285

COMPANY NAME	ROCE	OPERATING PROFIT	EMPLOYEES	HPD	MARKET VALUE (m)
I1 REED INTL.			56,500	95,487	280
I1 REED INTL.	0.129	0.050	57,800	102,753	442
I1 REED INTL.	0.160	0.060	55,000	129,058	644
I1 REED INTL.	0.163	0.063	45,200	138,291	819
I1 REED INTL.	0.235	0.084	34,700	141,941	1,447
I1 REED INTL.	0.281	0.103		171,433	2,156
D8 SHELL TRANSPORT			32,000	120,385	3,580
D8 SHELL TRANSPORT			33,000	225,163	5,171
D8 SHELL TRANSPORT			81,000	245,948	4,419
D8 SHELL TRANSPORT	0.231	0.122	163,000	192,553	4,552
D8 SHELL TRANSPORT	0.207	0.095		202,434	6,275
D8 SHELL TRANSPORT	0.200	0.094	149,000	209,799	7,215
D8 SHELL TRANSPORT	0.213	0.084	142,000	296,722	7,325
D8 SHELL TRANSPORT	0.138	0.071		268,145	10,883
D8 SHELL TRANSPORT	0.157	0.069		265,430	11,104
A4 TARMAC			23,688	41,856	104
A4 TARMAC			21,739	56,615	141
A4 TARMAC			18,585	67,425	262
A4 TARMAC	0.261	0.074	19,566	95,000	577
A4 TARMAC	0.265	0.079	23,061	125,300	584
A4 TARMAC	0.223	0.092	24,264	140,000	795
A4 TARMAC	0.229	0.092	25,748	152,000	1,167
A4 TARMAC	0.244	0.105		182,000	1,309
A4 TARMAC				213,000	1,588
G2 TESCO			52,829	42,407	225
G2 TESCO			50,578	51,162	186
G2 TESCO			49,610	54,296	171
G2 TESCO	0.156	0.027	49,372	62,486	402
G2 TESCO	0.170	0.027	52,342	81,546	559
G2 TESCO	0.178	0.027	57,180	122,338	808
G2 TESCO	0.190	0.031	60,781	118,461	1,183
G2 TESCO	0.206	0.040		155,504	1,674
G2 TESCO				196,951	2,276
I1 TRAFALGAR HOUSE				70,000	140
I1 TRAFALGAR HOUSE			26,967	80,000	196
I1 TRAFALGAR HOUSE			26,332	95,000	257
I1 TRAFALGAR HOUSE	0.197	0.080	24,015	110,000	360
I1 TRAFALGAR HOUSE	0.219	0.072	16,160	105,000	533
I1 TRAFALGAR HOUSE	0.193	0.077	30,904	135,000	970
I1 TRAFALGAR HOUSE	0.174	0.078	31,249	190,000	1,192
I1 TRAFALGAR HOUSE	0.144	0.074	34,278	225,000	1,089
I1 TRAFALGAR HOUSE	0.139	0.083		236,000	1,490
H5 UNITED BISCUITS				32,018	205
H5 UNITED BISCUITS			42,000	40,000	256
H5 UNITED BISCUITS			41,000	53,000	358
H5 UNITED BISCUITS	0.203	0.071	40,000	64,000	402
H5 UNITED BISCUITS	0.213	0.070	40,400	75,000	424
H5 UNITED BISCUITS	0.189	0.067	40,881	87,000	631
H5 UNITED BISCUITS	0.199	0.068	41,131	96,000	976
H5 UNITED BISCUITS	0.197	0.076	41,467	122,000	949
H5 UNITED BISCUITS	0.233	0.085		154,000	1,073
H1 WHITBREAD A				34,288	296

COMPANY NAME	ROCE	OPERATING PROFIT	EMPLOYEES	HPD	MARKET VALUE (m)
H1 WHITBREAD A			40,916	41,901	361
H1 WHITBREAD A			40,217	47,630	338
H1 WHITBREAD A			39,496	51,200	576
H1 WHITBREAD A	0.092	0.090	36,961	61,566	468
H1 WHITBREAD A	0.103	0.080	39,581	76,856	811
H1 WHITBREAD A	0.107	0.083	42,786	116,122	936
H1 WHITBREAD A	0.116	0.092	47,132	96,280	1,025
H1 WHITBREAD A	0.119	0.094		120,692	1,195

	COMPANY NAME	SHARE PRICE (p)	DIVIDEND NET (p)	NET EARNI SHARE (p)	RETURN ON SALES
D5	BOC GROUP	57.00	4.20		0.052
D5	BOC GROUP	105.00	4.62		0.052
D5	BOC GROUP	152.00	5.11		0.061
D5	BOC GROUP	173.00	5.74	18.37	0.073
D5	BOC GROUP	297.00	6.30	14.28	0.067
D5	BOC GROUP	259.00	7.70	18.06	0.066
D5	BOC GROUP	289.00	9.38	26.48	0.090
D5	BOC GROUP	372.00	10.79	26.52	0.099
D5	BOC GROUP	382.00	12.80	36.85	0.134
D6	BTR	31.30	1.25		0.138
D6	BTR	54.52	1.58		0.138
D6	BTR	76.00	1.94		0.141
D6	BTR	84.00	2.22	6.35	0.147
D6	BTR	142.34	2.83	8.47	0.087
D6	BTR	204.67	4.33	12.20	0.082
D6	BTR	252.00	5.83	16.02	0.093
D6	BTR	269.00	8.25	21.23	0.126
D6	BTR	275.00	9.70	23.57	0.142
E7	BUNZL	16.12	1.03		0.032
E7	BUNZL	17.06	1.13		0.032
E7	BUNZL	24.10	1.25		0.032
E7	BUNZL	35.53	1.41	4.10	0.035
E7	BUNZL	61.51	1.70	5.29	0.032
E7	BUNZL	133.96	2.30	7.19	0.032
E7	BUNZL	167.27	3.20	9.62	0.054
E7	BUNZL	208.00	4.20	11.95	0.061
E7	BUNZL	160.00	5.00		0.058
G6	BURTON GROUP	29.00	1.25		0.075
G6	BURTON GROUP	23.50	1.38		0.075
G6	BURTON GROUP	33.25	1.63		0.075
G6	BURTON GROUP	75.50	1.94	5.96	0.119
G6	BURTON GROUP	106.00	2.50	8.21	0.130
G6	BURTON GROUP	210.50	3.25	10.44	0.134
G6	BURTON GROUP	277.50	4.40	14.30	0.144
G6	BURTON GROUP	284.00	5.70	17.71	0.121
G6	BURTON GROUP	221.00	7.20	21.00	0.136
H3	CADBURY SCHWEPPS	54.19	3.79	21.00	0.055
H3	CADBURY SCHWEPPS	69.96	4.04		0.055
H3	CADBURY SCHWEPPS	86.00	4.60		0.063
H3	CADBURY SCHWEPPS	117.00	4.90	10.94	0.057
H3	CADBURY SCHWEPPS	118.00	5.40	13.28	0.063
H3	CADBURY SCHWEPPS	163.00	5.90	15.56	0.062
H3	CADBURY SCHWEPPS	158.00	5.90	9.15	0.050
H3	CADBURY SCHWEPPS	186.00	6.70	14.37	0.071
H3	CADBURY SCHWEPPS	232.00	8.00	18.67	0.087
G6	DIXONS	21.83	0.68		0.052
G6	DIXONS	30.14	0.79		0.052
G6	DIXONS	39.86	0.83		0.052
G6	DIXONS	56.95	0.90		0.052
G6	DIXONS	58.49	0.97	5.66	0.052
G6	DIXONS	139.89	1.22	7.25	0.059
G6	DIXONS	221.53	1.46	8.69	0.065

COMPANY NAME	SHARE PRICE (p)	DIVIDEND NET (p)	NET EARNI SHARE (p)	RETURN ON SALES
G6 DIXONS	310.97	2.92	13.70	0.083
G6 DIXONS	207.00	3.97	19.21	0.092
D5 FISONS	29.08	1.83		0.008
D5 FISONS	21.64	1.11		0.008
D5 FISONS	17.54	1.11		0.019
D5 FISONS	47.50	1.42	4.43	0.089
D5 FISONS	85.88	1.81	6.95	0.112
D5 FISONS	139.85	2.17	9.41	0.095
D5 FISONS	214.92	2.75	12.15	0.120
D5 FISONS	259.76	3.25	13.74	0.128
D5 FISONS	241.73	4.00	15.69	0.140
F1 GRANADA GROUP	136.00	3.99		0.083
F1 GRANADA GROUP	180.00	5.58		0.083
F1 GRANADA GROUP	214.00	6.68		0.083
F1 GRANADA GROUP	199.00	6.23		0.083
F1 GRANADA GROUP	184.00	5.80		0.083
F1 GRANADA GROUP	194.00	6.40	14.58	0.085
F1 GRANADA GROUP	210.00	7.10	12.66	0.085
F1 GRANADA GROUP	294.00	8.50	21.17	0.111
F1 GRANADA GROUP	295.71	9.80	25.50	0.110
F2 GRAND METROPLTN	93.70	4.20		0.059
F2 GRAND METROPLTN	112.89	4.89		0.059
F2 GRAND METROPLTN	138.71	5.48		0.058
F2 GRAND METROPLTN	253.04	6.34	20.16	0.057
F2 GRAND METROPLTN	250.01	7.29	24.30	0.066
F2 GRAND METROPLTN	286.37	8.36	27.65	0.066
F2 GRAND METROPLTN	361.82	9.09	29.82	0.062
F2 GRAND METROPLTN	458.00	10.20	30.44	0.072
F2 GRAND METROPLTN	450.00	12.00	35.90	0.079
I1 HANSON TRUST	9.94	0.53		0.057
I1 HANSON TRUST	16.89	0.69		0.057
I1 HANSON TRUST	23.53	0.82		0.058
I1 HANSON TRUST	44.43	0.98	3.13	0.053
I1 HANSON TRUST	63.22	1.20	4.14	0.061
I1 HANSON TRUST	126.07	1.80	7.04	0.071
I1 HANSON TRUST	111.38	2.40	8.64	0.095
I1 HANSON TRUST	141.76	3.20	11.75	0.108
I1 HANSON TRUST	127.00	4.40	15.74	0.111
D5 IMP. CHEM.INDS	354.00	23.00		0.050
D5 IMP. CHEM.INDS	324.00	17.00		0.050
D5 IMP. CHEM.INDS	292.00	19.00		0.051
D5 IMP. CHEM.INDS	360.00	19.00	26.04	0.037
D5 IMP. CHEM.INDS	636.00	24.00	64.72	0.074
D5 IMP. CHEM.INDS	736.00	30.00	96.61	0.105
D5 IMP. CHEM.INDS	761.00	33.00	85.06	0.084
D5 IMP. CHEM.INDS	1,068.00	36.00	90.26	0.099
D5 IMP. CHEM.INDS	1,079.50	41.00	112.11	0.117
F3 LADBROKE GROUP	58.61	5.18		0.049
F3 LADBROKE GROUP	107.52	5.95		0.049
F3 LADBROKE GROUP	116.80	6.43		0.047
F3 LADBROKE GROUP	151.21	7.24	11.62	0.045
F3 LADBROKE GROUP	186.52	8.16	15.28	0.053

COMPANY NAME	SHARE PRICE (p)	DIVIDEND NET (p)	NET EARNI SHARE (p)	RETURN ON SALES
F3 LADBROKE GROUP	242.93	9.27	15.33	0.048
F3 LADBROKE GROUP	295.77	10.43	19.49	0.060
F3 LADBROKE GROUP	353.26	11.59	22.53	0.061
F3 LADBROKE GROUP	320.00	13.89		0.075
G6 MARKS & SPENCER	38.50	1.30		0.097
G6 MARKS & SPENCER	58.50	1.70		0.097
G6 MARKS & SPENCER	63.00	1.90		0.097
G6 MARKS & SPENCER	110.50	2.30		0.101
G6 MARKS & SPENCER	107.50	2.55	5.07	0.095
G6 MARKS & SPENCER	120.00	3.13	6.37	0.098
G6 MARKS & SPENCER	176.00	3.40	6.84	0.095
G6 MARKS & SPENCER	181.00	3.90	8.35	0.098
G6 MARKS & SPENCER	183.00	4.50	10.15	0.101
I1 PERSONS	97.50	5.00		0.062
I1 PERSONS	100.00	5.00		0.062
I1 PERSONS	105.50	5.60		0.085
I1 PERSONS	135.50	5.60	16.57	0.083
I1 PERSONS	204.00	7.00	22.65	0.106
I1 PERSONS	293.00	8.50	28.90	0.118
I1 PERSONS	435.00	10.00	29.94	0.113
I1 PERSONS	616.00	12.00	37.40	0.127
I1'PERSONS	688.00	15.00	46.70	0.159
B1 PLESSEY	64.83	2.10		0.100
B1 PLESSEY	85.89	2.31		0.100
B1 PLESSEY	121.00	2.54		0.100
B1 PLESSEY	203.00	2.87		0.116
B1 PLESSEY	228.00	3.30	11.32	0.136
B1 PLESSEY	212.00	3.80	15.03	0.144
B1 PLESSEY	172.00	4.38	12.34	0.115
B1 PLESSEY	184.00	5.03	13.44	0.116
B1 PLESSEY	144.00	5.79	15.90	0.128
B2 RANK ORG.	178.00	10.80		0.186
B2 RANK ORG.	172.00	10.80		0.186
B2 RANK ORG.	182.00	10.80		0.166
B2 RANK ORG.	106.00	8.00	12.25	0.089
B2 RANK ORG.	185.00	10.00	11.70	0.085
B2 RANK ORG.	296.00	12.00	20.64	0.122
B2 RANK ORG.	437.00	15.00	31.33	0.202
B2 RANK ORG.	523.00	18.00	43.64	0.223
B2 RANK ORG.	556.00	21.75	54.71	0.300
A1 REDLAND	136.75	5.12		0.091
A1 REDLAND	161.18	6.52		0.091
A1 REDLAND	151.41	7.17		0.091
A1 REDLAND	229.55	7.17		0.076
A1 REDLAND	250.06	7.91	14.96	0.075
A1 REDLAND	290.11	9.30	23.76	0.103
A1 REDLAND	334.07	10.27	25.72	0.108
A1 REDLAND	403.00	11.30	27.73	0.115
A1 REDLAND	405.00	13.00	35.90	0.133
H4 REED INTL.	43.00	2.00		0.034
I1 REED INTL.	47.00	3.25		0.034
I1 REED INTL.	60.50	3.25		0.034

COMPANY NAME	SHARE PRICE (p)	DIVIDEND NET (p)	NET EARNI SHARE (p)	RETURN ON SALES
I1 REED INTL.	59.50	3.50		0.042
I1 REED INTL.	93.50	3.50	9.00	0.041
I1 REED INTL.	135.50	4.10	15.29	0.052
I1 REED INTL.	171.75	4.60	14.36	0.053
I1 REED INTL.	303.00	5.60	22.45	0.078
I1 REED INTL.	397.00	8.00	26.51	0.096
D8 SHELL TRANSPORT	324.00	18.76		0.073
D8 SHELL TRANSPORT	468.00	19.10		0.073
D8 SHELL TRANSPORT	400.00	20.50		0.063
D8 SHELL TRANSPORT	412.00	21.80	68.73	0.154
D8 SHELL TRANSPORT	568.00	26.20	96.00	0.122
D8 SHELL TRANSPORT	653.00	33.00	127.52	0.118
D8 SHELL TRANSPORT	663.00	35.00	101.48	0.110
D8 SHELL TRANSPORT	985.00	43.00	79.97	0.095
D8 SHELL TRANSPORT	1005.00	48.00	90.39	0.091
A4 TARMAC	23.50	1.72		0.050
A4 TARMAC	30.88	2.00		0.050
A4 TARMAC	50.25	2.30		0.057
A4 TARMAC	109.00	2.75	8.71	0.070
A4 TARMAC	107.50	3.40	11.29	0.078
A4 TARMAC	129.50	4.00	12.48	0.082
A4 TARMAC	189.00	4.70	12.04	0.080
A4 TARMAC	212.00	5.54	16.16	0.094
A4 TARMAC	225.00	7.25		0.121
G2 TESCO	22.14	0.65		0.017
G2 TESCO	18.37	0.80		0.017
G2 TESCO	16.89	0.84		0.017
G2 TESCO	39.36	0.98		0.018
G2 TESCO	54.44	1.17	4.08	0.023
G2 TESCO	78.38	1.37	4.15	0.026
G2 TESCO	96.00	1.62	4.76	0.027
G2 TESCO	132.34	1.93	6.22	0.037
G2 TESCO	156.00	2.43	8.67	0.046
I1 TRAFALGAR HOUSE	54.79	4.32		0.046
I1 TRAFALGAR HOUSE	76.79	5.08		0.046
I1 TRAFALGAR HOUSE	100.20	5.81		0.046
I1 TRAFALGAR HOUSE	147.13	7.06	19.92	0.071
I1 TRAFALGAR HOUSE	215.79	8.50	23.99	0.066
I1 TRAFALGAR HOUSE	331.52	10.00	28.93	0.077
I1 TRAFALGAR HOUSE	346.00	11.50	33.09	0.076
I1 TRAFALGAR HOUSE	274.00	13.20	25.13	0.069
I1 TRAFALGAR HOUSE	305.00	14.50	29.20	0.069
H5 UNITED BISCUITS	77.40	3.58		0.060
H5 UNITED BISCUITS	81.05	4.27		0.060
H5 UNITED BISCUITS	113.27	5.13		0.069
H5 UNITED BISCUITS	125.97	5.66	14.46	0.057
H5 UNITED BISCUITS	131.83	6.84	18.04	0.058
H5 UNITED BISCUITS	193.34	7.50	19.46	0.053
H5 UNITED BISCUITS	240.00	8.00	19.28	0.057
H5 UNITED BISCUITS	233.00	9.50	20.54	0.069
H5 UNITED BISCUITS	263.00	11.00	23.39	0.080
H1 WHITBREAD A	84.67	3.17		0.085

COMPANY NAME	SHARE PRICE (p)	DIVIDEND NET (p)	NET EARNI SHARE (p)	RETURN ON SALES
H1 WHITBREAD A	100.67	4.00		0.085
H1 WHITBREAD A	93.00	4.47		0.085
H1 WHITBREAD A	158.00	4.90		0.087
H1 WHITBREAD A	128.00	5.40	13.93	0.080
H1 WHITBREAD A	219.00	6.30	19.48	0.079
H1 WHITBREAD A	251.00	7.00	20.31	0.075
H1 WHITBREAD A	270.00	7.80	21.84	0.083
H1 WHITBREAD A	290.00	8.90	23.73	0.096

COMPANY NAME	RETURN ON EQUITY	% GROWTH IN EQUITY	index EQUITY	CUM.GROWTH IN EQUITY
D5 BOC GROUP	0.123			
D5 BOC GROUP	0.106	0.128	-0.043	-0.043
D5 BOC GROUP	0.118	0.353	0.210	0.166
D5 BOC GROUP	0.126	0.131	0.041	0.208
D5 BOC GROUP	0.110	0.174	0.122	0.330
D5 BOC GROUP	0.114	0.155	0.101	0.431
D5 BOC GROUP	0.152	-0.062	-0.116	0.315
D5 BOC GROUP	0.186	-0.083	-0.113	0.202
D5 BOC GROUP	0.268	-0.051	-0.089	0.112
D6 BTR	0.400			
D6 BTR	0.318	0.483	0.258	0.258
D6 BTR	0.417	-0.023	-0.127	0.131
D6 BTR	0.336	0.468	0.352	0.483
D6 BTR	0.246	1.183	1.087	1.570
D6 BTR	0.335	0.224	0.166	1.736
D6 BTR	0.356	0.199	0.130	1.866
D6 BTR	0.404	0.232	0.191	2.058
D6 BTR	0.458	0.031	-0.011	2.047
E7 BUNZL	0.142			
E7 BUNZL	0.088	0.192	0.011	0.011
E7 BUNZL	0.118	0.081	-0.034	-0.023
E7 BUNZL	0.191	-0.006	-0.085	-0.108
E7 BUNZL	0.246	0.058	0.011	-0.097
E7 BUNZL	0.365	0.075	0.024	-0.073
E7 BUNZL	0.316	0.786	0.684	0.611
E7 BUNZL	0.207	1.320	1.244	1.855
E7 BUNZL		-1.000	-1.000	0.855
G6 BURTON GROUP	0.087			
G6 BURTON GROUP	0.134	-0.113	-0.248	-0.248
G6 BURTON GROUP	0.118	0.103	-0.014	-0.262
G6 BURTON GROUP	0.112	0.555	0.432	0.171
G6 BURTON GROUP	0.162	0.106	0.057	0.228
G6 BURTON GROUP	0.215	0.091	0.039	0.267
G6 BURTON GROUP	0.215	0.416	0.335	0.602
G6 BURTON GROUP	0.337	0.193	0.154	0.756
G6 BURTON GROUP	0.349	0.188	0.140	0.896
H3 CADBURY SCHWEPPS	0.202			
H3 CADBURY SCHWEPPS	0.210	0.070	-0.093	-0.093
H3 CADBURY SCHWEPPS	0.210	0.315	0.175	0.082
H3 CADBURY SCHWEPPS	0.230	0.014	-0.066	0.016
H3 CADBURY SCHWEPPS	0.270	0.019	-0.026	-0.010
H3 CADBURY SCHWEPPS	0.241	0.300	0.238	0.228
H3 CADBURY SCHWEPPS	0.199	-0.093	-0.144	0.083
H3 CADBURY SCHWEPPS	0.284	-0.017	-0.049	0.035
H3 CADBURY SCHWEPPS	0.372	0.029	-0.012	0.023
G6 DIXONS	0.237			
G6 DIXONS	0.208	0.196	0.014	0.014
G6 DIXONS	0.201	0.091	-0.025	-0.011
G6 DIXONS	0.188	0.167	0.074	0.063
G6 DIXONS	0.167	0.193	0.140	0.204
G6 DIXONS	0.182	0.354	0.290	0.494
G6 DIXONS	0.274	0.280	0.206	0.700

COMPANY NAME	RETURN ON EQUITY	% GROWTH IN EQUITY	index EQUITY	CUM.GROWTH IN EQUITY
G6 DIXONS	0.453	0.191	0.152	0.853
G6 DIXONS	0.446	0.334	0.280	1.133
D5 FISONS	0.022			
D5 FISONS	0.026	-0.110	-0.245	-0.245
D5 FISONS	0.071	-0.103	-0.198	-0.443
D5 FISONS	0.153	0.047	-0.036	-0.479
D5 FISONS	0.182	0.255	0.200	-0.279
D5 FISONS	0.267	0.049	-0.001	-0.280
D5 FISONS	0.249	0.609	0.517	0.237
D5 FISONS	0.279	0.051	0.016	0.254
D5 FISONS	0.306	0.079	0.036	0.289
F1 GRANADA GROUP	0.190			
F1 GRANADA GROUP	0.234	-0.033	-0.180	-0.180
F1 GRANADA GROUP	0.217	0.254	0.121	-0.059
F1 GRANADA GROUP	0.238	0.088	0.002	-0.057
F1 GRANADA GROUP	0.245	0.099	0.051	-0.006
F1 GRANADA GROUP	0.203	0.492	0.422	0.416
F1 GRANADA GROUP	0.247	-0.010	-0.066	0.350
F1 GRANADA GROUP	0.256	0.381	0.336	0.686
F1 GRANADA GROUP	0.274	0.121	0.076	0.761
F2 GRAND METROPLTN	0.144			
F2 GRAND METROPLTN	0.123	0.391	0.180	0.180
F2 GRAND METROPLTN	0.154	-0.020	-0.124	0.055
F2 GRAND METROPLTN	0.155	0.171	0.079	0.134
F2 GRAND METROPLTN	0.190	0.094	0.045	0.179
F2 GRAND METROPLTN	0.193	0.114	0.062	0.241
F2 GRAND METROPLTN	0.178	0.128	0.063	0.304
F2 GRAND METROPLTN	0.188	0.041	0.007	0.311
F2 GRAND METROPLTN	0.262	-0.152	-0.186	0.126
I1 HANSON TRUST	0.352			
I1 HANSON TRUST	0.323	0.131	-0.041	-0.041
I1 HANSON TRUST	0.301	0.364	0.219	0.178
I1 HANSON TRUST	0.320	0.142	0.052	0.230
I1 HANSON TRUST	0.212	1.275	1.175	1.405
I1 HANSON TRUST	0.412	-0.043	-0.089	1.316
I1 HANSON TRUST	0.259	1.379	1.243	2.559
I1 HANSON TRUST	0.322	0.474	0.426	2.985
I1 HANSON TRUST	0.428	0.202	0.154	3.139
D5 IMP. CHEM.INDS	0.095			
D5 IMP. CHEM.INDS	0.094	0.076	-0.088	-0.088
D5 IMP. CHEM.INDS	0.113	-0.018	-0.123	-0.210
D5 IMP. CHEM.INDS	0.083	0.099	0.013	-0.198
D5 IMP. CHEM.INDS	0.173	0.087	0.039	-0.159
D5 IMP. CHEM.INDS	0.258	0.137	0.084	-0.075
D5 IMP. CHEM.INDS	0.245	-0.083	-0.135	-0.210
D5 IMP. CHEM.INDS	0.261	0.045	0.010	-0.200
D5 IMP. CHEM.INDS	0.363	-0.069	-0.106	-0.306
F3 LADBROKE GROUP	0.222			
F3 LADBROKE GROUP	0.223	0.141	-0.033	-0.033
F3 LADBROKE GROUP	0.173	0.301	0.163	0.130
F3 LADBROKE GROUP	0.151	0.095	0.008	0.138
F3 LADBROKE GROUP	0.189	0.050	0.004	0.143

COMPANY NAME	RETURN ON EQUITY	% GROWTH IN EQUITY	index EQUITY	CUM.GROWTH IN EQUITY
F3 LADBROKE GROUP	0.152	0.510	0.439	0.581
F3 LADBROKE GROUP	0.138	0.654	0.559	1.140
F3 LADBROKE GROUP	0.145	0.281	0.239	1.379
F3 LADBROKE GROUP				
G6 MARKS & SPENCER				
G6 MARKS & SPENCER	0.294			
G6 MARKS & SPENCER	0.303	0.091	-0.025	-0.025
G6 MARKS & SPENCER	0.209	0.779	0.639	0.614
G6 MARKS & SPENCER	0.208	0.074	0.027	0.641
G6 MARKS & SPENCER	0.229	0.072	0.021	0.662
G6 MARKS & SPENCER	0.229	0.080	0.019	0.681
G6 MARKS & SPENCER	0.251	0.096	0.060	0.741
G6 MARKS & SPENCER	0.270	0.087	0.044	0.784
I1 PERSONS	0.154			
I1 PERSONS	0.155	0.215	0.031	0.031
I1 PERSONS	0.221	0.139	0.018	0.049
I1 PERSONS	0.188	0.179	0.086	0.135
I1 PERSONS	0.231	0.051	0.004	0.139
I1 PERSONS	0.252	0.180	0.124	0.263
I1 PERSONS	0.281	-0.015	-0.071	0.192
I1 PERSONS	0.273	0.143	0.105	0.297
I1 PERSONS	0.256	0.337	0.284	0.580
B1 PLESSEY	0.229			
B1 PLESSEY	0.252	0.202	0.019	0.019
B1 PLESSEY	0.235	0.208	0.080	0.099
B1 PLESSEY	0.273	0.133	0.044	0.142
B1 PLESSEY	0.357	0.007	-0.037	0.105
B1 PLESSEY	0.356	0.204	0.147	0.252
B1 PLESSEY	0.304	0.078	0.016	0.269
B1 PLESSEY	0.319	-0.002	-0.034	0.234
B1 PLESSEY	0.301	0.142	0.096	0.331
B2 RANK ORG.	0.214			
B2 RANK ORG.	0.217	0.094	-0.072	-0.072
B2 RANK ORG.	0.181	0.105	-0.012	-0.085
B2 RANK ORG.	0.113	-0.058	-0.133	-0.218
B2 RANK ORG.	0.118	-0.008	-0.051	-0.269
B2 RANK ORG.	0.167	-0.008	-0.055	-0.324
B2 RANK ORG.	0.242	0.005	-0.053	-0.377
B2 RANK ORG.	0.285	0.065	0.030	-0.347
B2 RANK ORG.	0.329	0.085	0.042	-0.305
A1 REDLAND				
A1 REDLAND	0.368			
A1 REDLAND	0.346	0.107	-0.011	-0.011
A1 REDLAND	0.267	0.207	0.112	0.101
A1 REDLAND	0.245	0.501	0.435	0.536
A1 REDLAND	0.398	-0.036	-0.081	0.455
A1 REDLAND	0.363	0.210	0.140	0.595
A1 REDLAND	0.347	0.067	0.032	0.627
A1 REDLAND	0.262	0.638	0.573	1.199
H4 REED INTL.				
I1 REED INTL.	0.105			
I1 REED INTL.	0.080	0.285	0.148	0.148

COMPANY NAME	RETURN ON EQUITY	% GROWTH IN EQUITY	index EQUITY	CUM.GROWTH IN EQUITY
I1 REED INTL.	0.107	0.060	-0.024	0.125
I1 REED INTL.	0.125	-0.114	-0.153	-0.028
I1 REED INTL.	0.164	0.084	0.033	0.005
I1 REED INTL.	0.174	0.004	-0.053	-0.049
I1 REED INTL.	0.239	-0.029	-0.061	-0.110
I1 REED INTL.	0.272	0.102	0.058	-0.052
D8 SHELL TRANSPORT	0.398			
D8 SHELL TRANSPORT	0.521	0.151	-0.024	-0.024
D8 SHELL TRANSPORT	0.498	0.100	-0.017	-0.041
D8 SHELL TRANSPORT	0.434	0.281	0.180	0.139
D8 SHELL TRANSPORT	0.385	0.157	0.106	0.244
D8 SHELL TRANSPORT	0.342	0.302	0.240	0.485
D8 SHELL TRANSPORT	0.342	-0.080	-0.133	0.352
D8 SHELL TRANSPORT	0.210	0.068	0.033	0.384
D8 SHELL TRANSPORT	0.238	-0.083	-0.120	0.265
A4 TARMAC	0.330			
A4 TARMAC	0.273	0.278	0.084	0.084
A4 TARMAC	0.257	0.261	0.127	0.210
A4 TARMAC	0.296	0.143	0.053	0.263
A4 TARMAC	0.347	0.090	0.042	0.306
A4 TARMAC	0.315	0.317	0.255	0.561
A4 TARMAC	0.288	0.279	0.206	0.767
A4 TARMAC	0.330	0.152	0.114	0.881
A4 TARMAC				0.881
G2 TESCO	0.132			
G2 TESCO	0.136	0.208	0.024	0.024
G2 TESCO	0.126	0.185	0.059	0.083
G2 TESCO	0.133	0.139	0.049	0.133
G2 TESCO	0.160	0.044	-0.002	0.130
G2 TESCO	0.177	0.133	0.080	0.210
G2 TESCO	0.138	0.549	0.460	0.670
G2 TESCO	0.178	0.172	0.134	0.804
G2 TESCO				
I1 TRAFALGAR HOUSE				
I1 TRAFALGAR HOUSE	0.293			
I1 TRAFALGAR HOUSE	0.301	0.089	-0.027	-0.027
I1 TRAFALGAR HOUSE	0.285	0.242	0.144	0.117
I1 TRAFALGAR HOUSE	0.302	0.142	0.092	0.209
I1 TRAFALGAR HOUSE	0.317	0.256	0.196	0.405
I1 TRAFALGAR HOUSE	0.248	0.543	0.455	0.860
I1 TRAFALGAR HOUSE	0.290	-0.176	-0.203	0.657
I1 TRAFALGAR HOUSE	0.203	0.766	0.695	1.352
H5 UNITED BISCUITS				
H5 UNITED BISCUITS	0.246			
H5 UNITED BISCUITS	0.203	0.546	0.382	0.382
H5 UNITED BISCUITS	0.259	-0.119	-0.189	0.193
H5 UNITED BISCUITS	0.322	-0.024	-0.067	0.126
H5 UNITED BISCUITS	0.290	0.167	0.112	0.239
H5 UNITED BISCUITS	0.247	0.374	0.296	0.534
H5 UNITED BISCUITS	0.277	0.094	0.058	0.593
H5 UNITED BISCUITS	0.300	0.081	0.038	0.630
H1 WHITBREAD A				

	COMPANY NAME	RETURN ON EQUITY	% GROWTH IN EQUITY	index EQUITY	CUM.GROWTH IN EQUITY
H1	WHITBREAD A	0.145			
H1	WHITBREAD A	0.087	0.766	0.578	0.578
H1	WHITBREAD A	0.093	0.037	-0.045	0.533
H1	WHITBREAD A	0.099	0.027	-0.018	0.514
H1	WHITBREAD A	0.110	0.049	-0.000	0.514
H1	WHITBREAD A	0.107	0.196	0.127	0.641
H1	WHITBREAD A	0.117	0.071	0.036	0.677
H1	WHITBREAD A	0.128	0.065	0.022	0.699

COMPANY NAME	SALES GROWTH RATIO	CUM.GROWTH SALES(%)	TOTAL ANNUAL INVESTORS RETURN	
D5 BOC GROUP				0.85
D5 BOC GROUP	-0.028	-0.176	0.923	1.00
D5 BOC GROUP	0.276	-0.036	0.496	1.12
D5 BOC GROUP	0.007	-0.108	0.176	1.22
D5 BOC GROUP	0.109	-0.048	0.753	1.27
D5 BOC GROUP	0.236	0.129	-0.102	1.33
D5 BOC GROUP	-0.096	-0.019	0.152	1.42
D5 BOC GROUP	0.023	-0.029	0.325	1.46
D5 BOC GROUP	0.007	-0.062	0.061	1.52
D6 BTR				
D6 BTR	0.178	-0.001	0.792	
D6 BTR	0.251	0.117	0.430	
D6 BTR	0.136	0.163	0.134	
D6 BTR	1.717	1.761	0.728	
D6 BTR	0.770	2.447	0.468	
D6 BTR	0.113	2.497	0.260	
D6 BTR	0.036	2.498	0.100	
D6 BTR	0.033	2.490	0.058	
E7 BUNZL				
E7 BUNZL	-0.261	-0.373	0.128	
E7 BUNZL	0.447	-0.080	0.486	
E7 BUNZL	0.470	0.273	0.533	
E7 BUNZL	0.495	0.703	0.779	
E7 BUNZL	0.619	1.245	1.215	
E7 BUNZL	-0.100	1.094	0.273	
E7 BUNZL	0.355	1.405	0.269	
E7 BUNZL	0.378	1.728	-0.207	
G6 BURTON GROUP				
G6 BURTON GROUP	0.370	0.162	-0.142	
G6 BURTON GROUP	-0.031	0.027	0.484	
G6 BURTON GROUP	-0.071	-0.117	1.329	
G6 BURTON GROUP	0.470	0.289	0.437	
G6 BURTON GROUP	0.393	0.616	1.017	
G6 BURTON GROUP	0.322	0.862	0.339	
G6 BURTON GROUP	1.230	2.019	0.044	
G6 BURTON GROUP	0.089	2.065	-0.196	
H3 CADBURY SCHWEPPS				
H3 CADBURY SCHWEPPS	0.112	-0.057	0.366	
H3 CADBURY SCHWEPPS	0.136	-0.042	0.295	
H3 CADBURY SCHWEPPS	0.241	0.102	0.417	
H3 CADBURY SCHWEPPS	0.079	0.133	0.055	
H3 CADBURY SCHWEPPS	0.184	0.261	0.431	
H3 CADBURY SCHWEPPS	-0.071	0.138	0.006	
H3 CADBURY SCHWEPPS	-0.018	0.087	0.220	
H3 CADBURY SCHWEPPS	0.104	0.147	0.290	
G6 DIXONS				
G6 DIXONS	0.053	-0.107	0.417	
G6 DIXONS	0.050	-0.169	0.350	
G6 DIXONS	0.091	-0.164	0.451	
G6 DIXONS	0.069	-0.141	0.044	
G6 DIXONS	0.307	0.104	1.413	
G6 DIXONS	0.730	0.735	0.594	

COMPANY NAME	SALES GROWTH RATIO	CUM.GROWTH SALES(%)	TOTAL ANNUAL INVESTORS RETURN
G6 DIXONS	0.555	1.238	0.417
G6 DIXONS	0.178	1.369	-0.322
D5 FISONS			
D5 FISONS	0.048	-0.111	-0.218
D5 FISONS	0.088	-0.138	-0.138
D5 FISONS	-0.524	-0.700	1.789
D5 FISONS	0.188	-0.565	0.846
D5 FISONS	0.812	0.162	0.654
D5 FISONS	0.187	0.281	0.556
D5 FISONS	0.105	0.350	0.224
D5 FISONS	0.085	0.391	-0.054
F1 GRANADA GROUP			
F1 GRANADA GROUP	0.191	0.010	0.365
F1 GRANADA GROUP	0.163	0.049	0.226
F1 GRANADA GROUP	0.195	0.150	-0.041
F1 GRANADA GROUP	0.133	0.232	-0.046
F1 GRANADA GROUP	0.210	0.385	0.089
F1 GRANADA GROUP	0.209	0.525	0.119
F1 GRANADA GROUP	0.097	0.586	0.440
F1 GRANADA GROUP	0.213	0.750	0.039
F2 GRAND METROPLTN			
F2 GRAND METROPLTN	0.190	0.009	0.257
F2 GRAND METROPLTN	0.247	0.123	0.277
F2 GRAND METROPLTN	0.195	0.224	0.870
F2 GRAND METROPLTN	0.161	0.334	0.017
F2 GRAND METROPLTN	0.136	0.416	0.179
F2 GRAND METROPLTN	0.101	0.454	0.295
F2 GRAND METROPLTN	-0.053	0.370	0.294
F2 GRAND METROPLTN	0.078	0.405	0.009
I1 HANSON TRUST			
I1 HANSON TRUST	0.040	-0.118	0.769
I1 HANSON TRUST	0.251	-0.000	0.442
I1 HANSON TRUST	0.341	0.235	0.930
I1 HANSON TRUST	0.292	0.471	0.450
I1 HANSON TRUST	0.605	1.000	1.023
I1 HANSON TRUST	0.123	1.059	-0.097
I1 HANSON TRUST	0.612	1.618	0.301
I1 HANSON TRUST	0.550	2.106	-0.073
D5 IMP. CHEM.INDS			
D5 IMP. CHEM.INDS	0.065	-0.097	-0.037
D5 IMP. CHEM.INDS	0.152	-0.068	-0.040
D5 IMP. CHEM.INDS	0.118	-0.038	0.298
D5 IMP. CHEM.INDS	0.122	0.034	0.833
D5 IMP. CHEM.INDS	0.200	0.178	0.204
D5 IMP. CHEM.INDS	0.082	0.198	0.079
D5 IMP. CHEM.INDS	-0.055	0.112	0.451
D5 IMP. CHEM.INDS	0.097	0.166	0.049
F3 LADBROKE GROUP			
F3 LADBROKE GROUP	0.149	-0.026	0.936
F3 LADBROKE GROUP	0.056	-0.083	0.146
F3 LADBROKE GROUP	-0.001	-0.163	0.357
F3 LADBROKE GROUP	0.124	-0.089	0.287

COMPANY NAME	SALES GROWTH RATIO	CUM.GROWTH SALES(%)	TOTAL ANNUAL INVESTORS RETURN
F3 LADBROKE GROUP	0.327	0.175	0.352
F3 LADBROKE GROUP	0.202	0.308	0.260
F3 LADBROKE GROUP	0.325	0.590	0.234
F3 LADBROKE GROUP		0.818	-0.055
G6 MARKS & SPENCER			
G6 MARKS & SPENCER	0.519	0.289	0.564
G6 MARKS & SPENCER	0.123	0.292	0.109
G6 MARKS & SPENCER	0.174	0.373	0.790
G6 MARKS & SPENCER	0.139	0.462	-0.004
G6 MARKS & SPENCER	0.139	0.548	0.145
G6 MARKS & SPENCER	0.119	0.603	0.495
G6 MARKS & SPENCER	0.163	0.728	0.051
G6 MARKS & SPENCER	0.136	0.818	0.036
I1 PERSONS			
I1 PERSONS	0.221	0.035	0.077
I1 PERSONS	0.188	0.097	0.111
I1 PERSONS	0.024	0.040	0.337
I1 PERSONS	0.016	0.011	0.557
I1 PERSONS	0.155	0.111	0.478
I1 PERSONS	0.150	0.196	0.519
I1 PERSONS	-0.018	0.146	0.444
I1 PERSONS	-0.000	0.105	0.141
B1 PLESSEY			
B1 PLESSEY	0.325	0.123	0.360
B1 PLESSEY	0.125	0.129	0.438
B1 PLESSEY	0.140	0.179	0.701
B1 PLESSEY	0.116	0.245	0.139
B1 PLESSEY	0.134	0.326	-0.054
B1 PLESSEY	0.161	0.421	-0.168
B1 PLESSEY	0.032	0.419	0.099
B1 PLESSEY	-0.021	0.359	-0.186
B2 RANK ORG.			
B2 RANK ORG.	0.110	-0.059	0.027
B2 RANK ORG.	0.035	-0.134	0.121
B2 RANK ORG.	0.093	-0.128	-0.374
B2 RANK ORG.	0.098	-0.078	0.840
B2 RANK ORG.	-0.027	-0.151	0.665
B2 RANK ORG.	-0.126	-0.326	0.527
B2 RANK ORG.	0.138	-0.226	0.238
B2 RANK ORG.	-0.069	-0.332	0.105
A1 REDLAND			
A1 REDLAND	0.179	-0.001	0.226
A1 REDLAND	0.040	-0.071	-0.016
A1 REDLAND	0.111	-0.048	0.563
A1 REDLAND	0.397	0.288	0.124
A1 REDLAND	0.145	0.378	0.197
A1 REDLAND	0.044	0.362	0.187
A1 REDLAND	-0.036	0.295	0.240
A1 REDLAND	0.064	0.316	0.037
H4 REED INTL.			
I1 REED INTL.	0.093	-0.073	0.169
I1 REED INTL.	-0.024	-0.201	0.356

COMPANY NAME	SALES GROWTH RATIO	CUM.GROWTH SALES(%)	TOTAL ANNUAL INVESTORS RETURN
I1 REED INTL.	0.148	-0.143	0.041
I1 REED INTL.	0.065	-0.126	0.630
I1 REED INTL.	0.129	-0.050	0.493
I1 REED INTL.	0.035	-0.073	0.301
I1 REED INTL.	-0.087	-0.190	0.797
I1 REED INTL.	0.010	-0.221	0.337
D8 SHELL TRANSPORT			
D8 SHELL TRANSPORT	0.509	0.279	0.503
D8 SHELL TRANSPORT	0.213	0.364	-0.101
D8 SHELL TRANSPORT	-0.539	-0.212	0.085
D8 SHELL TRANSPORT	0.297	0.028	0.442
D8 SHELL TRANSPORT	0.189	0.160	0.208
D8 SHELL TRANSPORT	-0.010	0.094	0.069
D8 SHELL TRANSPORT	-0.240	-0.171	0.551
D8 SHELL TRANSPORT	0.077	-0.137	0.069
A4 TARMAC			
A4 TARMAC	0.057	-0.103	0.399
A4 TARMAC	0.038	-0.175	0.702
A4 TARMAC	0.077	-0.184	1.224
A4 TARMAC	0.137	-0.097	0.017
A4 TARMAC	0.136	-0.014	0.242
A4 TARMAC	0.203	0.120	0.496
A4 TARMAC	0.119	0.202	0.151
A4 TARMAC	0.281	0.431	0.096
G2 TESCO			
G2 TESCO	0.251	0.061	-0.134
G2 TESCO	0.097	0.042	-0.035
G2 TESCO	0.144	0.095	1.388
G2 TESCO	-0.053	0.000	0.413
G2 TESCO	0.140	0.086	0.465
G2 TESCO	0.156	0.176	0.245
G2 TESCO	0.118	0.258	0.399
G2 TESCO	0.071	0.286	0.197
I1 TRAFALGAR HOUSE			
I1 TRAFALGAR HOUSE	0.127	-0.044	0.494
I1 TRAFALGAR HOUSE	0.116	-0.047	0.381
I1 TRAFALGAR HOUSE	-0.233	-0.340	0.539
I1 TRAFALGAR HOUSE	0.304	-0.093	0.524
I1 TRAFALGAR HOUSE	0.123	-0.023	0.583
I1 TRAFALGAR HOUSE	0.233	0.139	0.078
I1 TRAFALGAR HOUSE	0.054	0.159	-0.170
I1 TRAFALGAR HOUSE	0.229	0.339	0.166
H5 UNITED BISCUITS			
H5 UNITED BISCUITS	0.249	0.059	0.102
H5 UNITED BISCUITS	0.113	0.054	0.461
H5 UNITED BISCUITS	0.370	0.315	0.162
H5 UNITED BISCUITS	0.182	0.445	0.101
H5 UNITED BISCUITS	0.165	0.555	0.523
H5 UNITED BISCUITS	0.089	0.581	0.283
H5 UNITED BISCUITS	0.007	0.555	0.010
H5 UNITED BISCUITS	0.008	0.522	0.176
H1 WHITBREAD A			

	COMPANY NAME	SALES GROWTH RATIO	CUM.GROWTH SALES(%)	TOTAL ANNUAL INVESTORS RETURN
H1	WHITBREAD A	0.222	0.036	0.236
H1	WHITBREAD A	0.060	-0.017	-0.032
H1	WHITBREAD A	0.077	-0.025	0.752
H1	WHITBREAD A	0.190	0.112	-0.156
H1	WHITBREAD A	0.183	0.240	0.760
H1	WHITBREAD A	0.218	0.388	0.178
H1	WHITBREAD A	0.062	0.415	0.107
H1	WHITBREAD A	0.014	0.388	0.107

COMPANY NAME	INDEX fund	Index sales	
D5 BOC GROUP	606.132	1449	
D5 BOC GROUP	580.000	1194	-0.176
D5 BOC GROUP	701.519	1361	0.140
D5 BOC GROUP	730.453	1263	-0.072
D5 BOC GROUP	819.827	1339	0.060
D5 BOC GROUP	902.549	1576	0.177
D5 BOC GROUP	797.880	1343	-0.148
D5 BOC GROUP	707.450	1329	-0.010
D5 BOC GROUP	644.357	1285	-0.033
D6 BTR	175.708	511	
D6 BTR	221.000	510	-0.001
D6 BTR	193.029	570	0.118
D6 BTR	260.923	597	0.046
D6 BTR	544.532	1550	1.598
D6 BTR	635.007	2614	0.686
D6 BTR	717.668	2743	0.049
D6 BTR	855.092	2747	0.002
D6 BTR	846.063	2723	-0.009
E7 BUNZL	61.321	271	
E7 BUNZL	62.000	170	-0.373
E7 BUNZL	59.875	220	0.293
E7 BUNZL	54.809	298	0.353
E7 BUNZL	55.414	425	0.429
E7 BUNZL	56.747	656	0.543
E7 BUNZL	95.559	557	-0.152
E7 BUNZL	214.431	730	0.311
E7 BUNZL		965	0.323
G6 BURTON GROUP	167.453	195	
G6 BURTON GROUP	126.000	226	0.162
G6 BURTON GROUP	124.218	196	-0.134
G6 BURTON GROUP	177.936	167	-0.144
G6 BURTON GROUP	188.085	235	0.406
G6 BURTON GROUP	195.471	313	0.328
G6 BURTON GROUP	261.001	389	0.246
G6 BURTON GROUP	301.094	840	1.157
G6 BURTON GROUP	343.307	878	0.046
H3 CADBURY SCHWEPPS	321.934	1186	
H3 CADBURY SCHWEPPS	292.000	1119	-0.057
H3 CADBURY SCHWEPPS	343.164	1136	0.015
H3 CADBURY SCHWEPPS	320.412	1299	0.143
H3 CADBURY SCHWEPPS	312.038	1340	0.032
H3 CADBURY SCHWEPPS	386.357	1511	0.128
H3 CADBURY SCHWEPPS	330.530	1324	-0.124
H3 CADBURY SCHWEPPS	314.354	1258	-0.050
H3 CADBURY SCHWEPPS	310.630	1333	0.060
G6 DIXONS	54.245	245	
G6 DIXONS	55.000	219	-0.107
G6 DIXONS	53.619	206	-0.061
G6 DIXONS	57.613	207	0.005
G6 DIXONS	65.707	211	0.022
G6 DIXONS	84.775	263	0.245
G6 DIXONS	102.261	429	0.631

COMPANY NAME	INDEX fund	Index sales	
G6 DIXONS	117.840	645	0.504
G6 DIXONS	150.853	729	0.131
D5 FISONS	193.396	511	
D5 FISONS	146.000	454	-0.111
D5 FISONS	117.069	441	-0.028
D5 FISONS	112.912	193	-0.562
D5 FISONS	135.484	220	0.135
D5 FISONS	135.382	379	0.727
D5 FISONS	205.371	424	0.119
D5 FISONS	208.681	454	0.069
D5 FISONS	216.142	473	0.042
F1 GRANADA GROUP	143.868	328	
F1 GRANADA GROUP	118.000	331	0.010
F1 GRANADA GROUP	132.261	344	0.039
F1 GRANADA GROUP	132.510	379	0.100
F1 GRANADA GROUP	139.260	410	0.083
F1 GRANADA GROUP	198.022	473	0.153
F1 GRANADA GROUP	184.903	539	0.140
F1 GRANADA GROUP	247.024	572	0.061
F1 GRANADA GROUP	265.748	666	0.164
F2 GRAND METROPLTN	1049.528	2560	
F2 GRAND METROPLTN	1238.000	2583	0.009
F2 GRAND METROPLTN	1084.004	2878	0.114
F2 GRAND METROPLTN	1169.300	3167	0.100
F2 GRAND METROPLTN	1222.423	3516	0.110
F2 GRAND METROPLTN	1297.901	3804	0.082
F2 GRAND METROPLTN	1379.717	3950	0.038
F2 GRAND METROPLTN	1389.815	3617	-0.084
F2 GRAND METROPLTN	1131.824	3744	0.035
I1 HANSON TRUST	126.179	776	
I1 HANSON TRUST	121.000	684	-0.118
I1 HANSON TRUST	147.453	765	0.118
I1 HANSON TRUST	155.144	945	0.235
I1 HANSON TRUST	337.451	1168	0.235
I1 HANSON TRUST	307.571	1786	0.530
I1 HANSON TRUST	689.823	1890	0.058
I1 HANSON TRUST	983.595	2947	0.559
I1 HANSON TRUST	1135.171	4385	0.488
D5 IMP. CHEM.INDS	3299.528	6330	
D5 IMP. CHEM.INDS	3010.000	5715	-0.097
D5 IMP. CHEM.INDS	2640.751	5881	0.029
D5 IMP. CHEM.INDS	2674.074	6056	0.030
D5 IMP. CHEM.INDS	2778.127	6496	0.073
D5 IMP. CHEM.INDS	3010.495	7428	0.144
D5 IMP. CHEM.INDS	2603.534	7580	0.020
D5 IMP. CHEM.INDS	2630.212	6928	-0.086
D5 IMP. CHEM.INDS	2351.706	7299	0.053
F3 LADBROKE GROUP	150.943	683	
F3 LADBROKE GROUP	146.000	665	-0.026
F3 LADBROKE GROUP	169.794	627	-0.057
F3 LADBROKE GROUP	171.193	577	-0.080
F3 LADBROKE GROUP	171.912	620	0.074

COMPANY NAME	INDEX fund	Index sales	
F3 LADBROKE GROUP	247.301	784	0.264
F3 LADBROKE GROUP	385.583	888	0.133
F3 LADBROKE GROUP	477.649	1138	0.282
F3 LADBROKE GROUP		1398	0.229
G6 MARKS & SPENCER		1295	
G6 MARKS & SPENCER	548.000	1668	0.289
G6 MARKS & SPENCER	534.406	1674	0.003
G6 MARKS & SPENCER	875.720	1810	0.081
G6 MARKS & SPENCER	899.449	1971	0.089
G6 MARKS & SPENCER	918.591	2140	0.085
G6 MARKS & SPENCER	935.618	2257	0.055
G6 MARKS & SPENCER	991.798	2540	0.125
G6 MARKS & SPENCER	1035.039	2770	0.090
I1 PERSONS	229.953	571	
I1 PERSONS	237.000	591	0.035
I1 PERSONS	241.287	627	0.061
I1 PERSONS	262.016	591	-0.057
I1 PERSONS	263.155	575	-0.028
I1 PERSONS	295.785	632	0.100
I1 PERSONS	274.700	686	0.085
I1 PERSONS	303.554	651	-0.050
I1 PERSONS	389.633	625	-0.040
B1 PLESSEY	292.453	668	
B1 PLESSEY	298.000	751	0.123
B1 PLESSEY	321.716	755	0.006
B1 PLESSEY	335.802	793	0.050
B1 PLESSEY	323.338	846	0.067
B1 PLESSEY	370.921	914	0.081
B1 PLESSEY	377.027	1001	0.095
B1 PLESSEY	364.046	999	-0.002
B1 PLESSEY	399.147	938	-0.061
B2 RANK ORG.	553.066	634	
B2 RANK ORG.	513.000	597	-0.059
B2 RANK ORG.	506.702	552	-0.075
B2 RANK ORG.	439.371	556	0.006
B2 RANK ORG.	416.758	583	0.050
B2 RANK ORG.	393.928	541	-0.073
B2 RANK ORG.	373.074	446	-0.176
B2 RANK ORG.	384.211	491	0.101
B2 RANK ORG.	400.262	439	-0.106
A1 REDLAND		495	
A1 REDLAND	122.000	495	-0.001
A1 REDLAND	120.643	460	-0.070
A1 REDLAND	134.156	471	0.023
A1 REDLAND	192.526	629	0.335
A1 REDLAND	176.912	686	0.091
A1 REDLAND	201.767	675	-0.016
A1 REDLAND	208.134	629	-0.067
A1 REDLAND	327.297	642	0.021
H4 REED INTL.		1636	
I1 REED INTL.	491.000	1516	-0.073
I1 REED INTL.	563.896	1323	-0.128

COMPANY NAME	INDEX fund	Index sales	
I1 REED INTL.	550.617	1398	0.057
I1 REED INTL.	466.168	1423	0.018
I1 REED INTL.	481.559	1531	0.076
I1 REED INTL.	455.830	1495	-0.024
I1 REED INTL.	428.093	1320	-0.117
I1 REED INTL.	452.953	1280	-0.030
D8 SHELL TRANSPORT	4930.425	26776	
D8 SHELL TRANSPORT	4814.000	34257	0.279
D8 SHELL TRANSPORT	4731.903	37148	0.084
D8 SHELL TRANSPORT	5581.398	15762	-0.576
D8 SHELL TRANSPORT	6170.889	19542	0.240
D8 SHELL TRANSPORT	7654.421	22131	0.132
D8 SHELL TRANSPORT	6636.394	20665	-0.066
D8 SHELL TRANSPORT	6852.562	15187	-0.265
D8 SHELL TRANSPORT	6033.463	15698	0.034
A4 TARMAC	148.585	986	
A4 TARMAC	161.000	884	-0.103
A4 TARMAC	181.412	820	-0.072
A4 TARMAC	191.029	813	-0.008
A4 TARMAC	199.135	884	0.087
A4 TARMAC	249.925	957	0.083
A4 TARMAC	301.413	1086	0.134
A4 TARMAC	335.817	1175	0.082
A4 TARMAC		1444	0.230
G2 TESCO	232.311	1805	
G2 TESCO	238.000	1916	0.061
G2 TESCO	252.011	1878	-0.020
G2 TESCO	264.444	1979	0.053
G2 TESCO	263.808	1791	-0.095
G2 TESCO	284.858	1945	0.086
G2 TESCO	415.972	2120	0.090
G2 TESCO	471.702	2293	0.082
G2 TESCO		2358	0.028
I1 TRAFALGAR HOUSE		1116	
I1 TRAFALGAR HOUSE	168.000	1066	-0.044
I1 TRAFALGAR HOUSE	163.539	1063	-0.002
I1 TRAFALGAR HOUSE	187.079	751	-0.293
I1 TRAFALGAR HOUSE	204.245	937	0.247
I1 TRAFALGAR HOUSE	244.345	1003	0.070
I1 TRAFALGAR HOUSE	355.425	1166	0.163
I1 TRAFALGAR HOUSE	283.117	1189	0.020
I1 TRAFALGAR HOUSE	479.856	1403	0.180
H5 UNITED BISCUITS		747	
H5 UNITED BISCUITS	194.000	791	0.059
H5 UNITED BISCUITS	268.097	786	-0.006
H5 UNITED BISCUITS	217.531	992	0.261
H5 UNITED BISCUITS	202.990	1121	0.130
H5 UNITED BISCUITS	225.787	1244	0.110
H5 UNITED BISCUITS	292.509	1277	0.026
H5 UNITED BISCUITS	309.569	1243	-0.026
H5 UNITED BISCUITS	321.194	1202	-0.033
H1 WHITBREAD A		712	

COMPANY NAME	INDEX fund	Index sales	
H1 WHITBREAD A	431.000	738	0.036
H1 WHITBREAD A	680.071	699	-0.053
H1 WHITBREAD A	649.383	693	-0.008
H1 WHITBREAD A	637.372	788	0.137
H1 WHITBREAD A	637.106	889	0.128
H1 WHITBREAD A	718.092	1020	0.148
H1 WHITBREAD A	743.814	1048	0.027
H1 WHITBREAD A	760.302	1020	-0.027

NO PROFIT SCHEMES

IND. CODE	COMPANY	YEAR	YEAR END	TURNOVER (m)	PRE-TAX PROFIT(000)
H 1	ALLIED-LYONS	1979	MAR 79	2,000	117,765
H 1	ALLIED-LYONS	1980	MAR 80	2,200	105,874
H 1	ALLIED-LYONS	1981	MAR 81	2,268	112,400
H 1	ALLIED-LYONS	1982	MAR 82	2,398	141,200
H 1	ALLIED-LYONS	1983	MAR 83	2,643	144,600
H 1	ALLIED-LYONS	1984	MAR 84	2,851	178,600
H 1	ALLIED-LYONS	1985	MAR 85	3,175	192,700
H 1	ALLIED-LYONS	1986	MAR 86	3,302	234,600
H 1	ALLIED-LYONS	1987	MAR 87	3,615	303,278
H 5	ASSD.BRIT FOODS	1979	MAR 79	1,900	84,819
H 5	ASSD.BRIT FOODS	1980	MAR 80	2,146	95,801
H 5	ASSD.BRIT FOODS	1981	MAR 81	2,574	114,908
H 5	ASSD.BRIT FOODS	1982	APR 82	2,969	139,252
H 5	ASSD.BRIT FOODS	1983	APR 83	3,366	146,539
H 5	ASSD.BRIT FOODS	1984	APR 84	2,765	126,700
H 5	ASSD.BRIT FOODS	1985	MAR 85	2,931	132,300
H 5	ASSD.BRIT FOODS	1986	MAR 86	3,129	163,500
H 5	ASSD.BRIT FOODS	1987	MAR 87	2,202	187,700
H 1	BASS	1979	SEP 79	1,134	101,907
H 1	BASS	1980	SEP 80	1,263	113,500
H 1	BASS	1981	SEP 81	1,713	133,200
H 1	BASS	1982	SEP 82	1,861	123,700
H 1	BASS	1983	SEP 83	1,988	161,400
H 1	BASS	1984	SEP 84	2,252	210,200
H 1	BASS	1985	SEP 85	2,411	248,100
H 1	BASS	1986	SEP 86	2,710	296,100
H 1	BASS	1987	SEP 87	3,213	351,700
H 6	BAT INDS.	1979	DEC 79	7,228	452,873
H 6	BAT INDS.	1980	DEC 80	7,645	479,000
H 6	BAT INDS.	1981	DEC 81	9,265	684,000
H 6	BAT INDS.	1982	DEC 82	11,318	856,000
H 6	BAT INDS.	1983	DEC 83	11,652	979,000
H 6	BAT INDS.	1984	DEC 84	14,222	1,405,000
H 6	BAT INDS.	1985	DEC 85	12,525	1,168,000
H 6	BAT INDS.	1986	DEC 86	13,623	1,367,000
H 6	BAT INDS.	1987	DEC 87	17,208	1,394,000
D 7	BEECHAM GROUP	1979	MAR 79	990	124,765
D 7	BEECHAM GROUP	1980	MAR 80	1,028	129,554
D 7	BEECHAM GROUP	1981	MAR 81	1,195	150,600
D 7	BEECHAM GROUP	1982	MAR 82	1,407	201,900
D 7	BEECHAM GROUP	1983	MAR 83	1,702	237,100
D 7	BEECHAM GROUP	1984	MAR 84	1,944	267,900
D 7	BEECHAM GROUP	1985	MAR 85	2,289	306,100
D 7	BEECHAM GROUP	1986	MAR 86	2,603	303,800
D 7	BEECHAM GROUP	1987	MAR 87	2,730	350,400
A 5	BLUE CIRCLE IND	1979	DEC 79	528	65,150
A 5	BLUE CIRCLE IND	1980	DEC 80	637	78,600
A 5	BLUE CIRCLE IND	1981	DEC 81	750	104,100
A 5	BLUE CIRCLE IND	1982	DEC 82	785	106,500
A 5	BLUE CIRCLE IND	1983	DEC 83	907	112,200
A 5	BLUE CIRCLE IND	1984	DEC 84	870	127,700

IND. CODE		COMPANY	YEAR	YEAR END	TURNOVER (m)	PRE-TAX PROFIT(000)
A	5	BLUE CIRCLE IND	1985	DEC 85	947	116,900
A	5	BLUE CIRCLE IND	1986	DEC 86	1,098	132,100
A	5	BLUE CIRCLE IND	1987	DEC 87	1,068	155,000
G	6	BOOTS	1979	MAR 79	805	71,139
G	6	BOOTS	1980	MAR 80	1,202	106,203
G	6	BOOTS	1981	MAR 81	1,374	121,400
G	6	BOOTS	1982	MAR 82	1,487	124,700
G	6	BOOTS	1983	MAR 83	1,670	125,600
G	6	BOOTS	1984	MAR 84	1,833	154,800
G	6	BOOTS	1985	MAR 85	2,033	175,600
G	6	BOOTS	1986	MAR 86	2,126	187,800
G	6	BOOTS	1987	MAR 87	2,352	221,800
A	3	BPB INDUSTRIES	1979	MAR 79	239	27,892
A	3	BPB INDUSTRIES	1980	MAR 80	341	39,768
A	3	BPB INDUSTRIES	1981	MAR 81	361	42,100
A	3	BPB INDUSTRIES	1982	MAR 82	406	56,500
A	3	BPB INDUSTRIES	1983	MAR 83	466	65,430
A	3	BPB INDUSTRIES	1984	MAR 84	540	79,700
A	3	BPB INDUSTRIES	1985	MAR 85	564	78,600
A	3	BPB INDUSTRIES	1986	MAR 86	616	103,200
A	3	BPB INDUSTRIES	1987	MAR 87	751	144,700
D	8	BRIT. PETROLEUM	1979	DEC 79	22,706	4,270,112
D	8	BRIT. PETROLEUM	1980	DEC 80	25,848	4,861,000
D	8	BRIT. PETROLEUM	1981	DEC 81	30,624	2,432,000
D	8	BRIT. PETROLEUM	1982	DEC 82	29,336	2,305,000
D	8	BRIT. PETROLEUM	1983	DEC 83	37,960	2,593,000
D	8	BRIT. PETROLEUM	1984	DEC 84	44,059	3,455,000
D	8	BRIT. PETROLEUM	1985	DEC 85	47,156	3,613,000
D	8	BRIT. PETROLEUM	1986	DEC 86	34,247	958,000
D	8	BRIT. PETROLEUM	1987	DEC 87	34,932	2,387,000
E	9	COURTAULDS	1979	MAR 79	2339	49,718
E	9	COURTAULDS	1980	MAR 80	1,819	38,671
E	9	COURTAULDS	1981	MAR 81	1,710	5,100
E	9	COURTAULDS	1982	MAR 82	1,790	51,100
E	9	COURTAULDS	1983	MAR 83	1906	63,300
E	9	COURTAULDS	1984	MAR 84	2,038	117,800
E	9	COURTAULDS	1985	MAR 85	2,152	128,200
E	9	COURTAULDS	1986	MAR 86	2,173	143,000
E	9	COURTAULDS	1987	MAR 87	2,262	201,100
I	2	ENG. CHINA CLAYS	1979	SEP 79	281	34,285
I	2	ENG. CHINA CLAYS	1980	SEP 80	332	40,507
I	2	ENG. CHINA CLAYS	1981	SEP 81	345	41,692
I	2	ENG. CHINA CLAYS	1982	SEP 82	402	43,494
I	2	ENG. CHINA CLAYS	1983	SEP 83	490	46,473
I	2	ENG. CHINA CLAYS	1984	SEP 84	604	63,768
I	2	ENG. CHINA CLAYS	1985	SEP 85	714	74,648
I	2	ENG. CHINA CLAYS	1986	SEP 86	689	90,361
I	2	ENG. CHINA CLAYS	1987	SEP 87	763	110,500
D	7	GLAXO HLDGS	1979	JUN 79	539	66,296
D	7	GLAXO HLDGS	1980	JUN 80	618	76,013
D	7	GLAXO HLDGS	1981	JUN 81	710	87,329

IND. CODE		COMPANY	YEAR	YEAR END	TURNOVER (m)	PRE-TAX PROFIT(000)
D	7	GLAXO HLDGS	1982	JUN 82	866	133,636
D	7	GLAXO HLDGS	1983	JUN 83	1,028	192,700
D	7	GLAXO HLDGS	1984	JUN 84	1,200	258,900
D	7	GLAXO HLDGS	1985	JUN 85	1,412	402,300
D	7	GLAXO HLDGS	1986	JUN 86	1,429	571,600
D	7	GLAXO HLDGS	1987	JUN 87	1,741	750,000
B	1	HAWKER SIDDELEY	1979	DEC 79	1,110	107,800
B	1	HAWKER SIDDELEY	1980	DEC 80	1,205	113,000
B	1	HAWKER SIDDELEY	1981	DEC 81	1,395	121,100
B	1	HAWKER SIDDELEY	1982	DEC 82	1,407	123,000
B	1	HAWKER SIDDELEY	1983	DEC 83	1,457	145,000
B	1	HAWKER SIDDELEY	1984	DEC 84	1,600	156,800
B	1	HAWKER SIDDELEY	1985	DEC 85	1,592	154,900
B	1	HAWKER SIDDELEY	1986	DEC 86	1,608	144,300
B	1	HAWKER SIDDELEY	1987	DEC 87	1,743	163,200
A	3	PILKINGTON BROS	1979	MAR 79	475	48,865
A	3	PILKINGTON BROS	1980	MAR 80	629	64,738
A	3	PILKINGTON BROS	1981	MAR 81	787	81,000
A	3	PILKINGTON BROS	1982	MAR 82	959	53,400
A	3	PILKINGTON BROS	1983	MAR 83	1,022	76,000
A	3	PILKINGTON BROS	1984	MAR 84	1,214	103,100
A	3	PILKINGTON BROS	1985	MAR 85	1,227	133,000
A	3	PILKINGTON BROS	1986	MAR 86	1,321	123,700
A	3	PILKINGTON BROS	1987	MAR 87	2,103	267,800
B	2	RACAL ELECTRONIC	1979	MAR 79	145	19,752
B	2	RACAL ELECTRONIC	1980	MAR 80	263	35,923
B	2	RACAL ELECTRONIC	1981	MAR 81	536	73,211
B	2	RACAL ELECTRONIC	1982	MAR 82	644	102,616
B	2	RACAL ELECTRONIC	1983	MAR 83	762	114,268
B	2	RACAL ELECTRONIC	1984	MAR 84	816	119,245
B	2	RACAL ELECTRONIC	1985	MAR 85	1,107	132,305
B	2	RACAL ELECTRONIC	1986	MAR 86	1,266	81,994
B	2	RACAL ELECTRONIC	1987	MAR 87	1,291	103,439
H	5	RANK HOVIS	1979	AUG 79	1,422	35,127
H	5	RANK HOVIS	1980	AUG 80	1,456	35,963
H	5	RANK HOVIS	1981	SEPT 81	1,833	45,275
H	5	RANK HOVIS	1982	SEPT 82	1,598	34,367
H	5	RANK HOVIS	1983	SEPT 83	1,637	40,727
H	5	RANK HOVIS	1984	SEPT 84	1,230	52,020
H	5	RANK HOVIS	1985	SEPT 85	1,314	70,900
H	5	RANK HOVIS	1986	SEPT 86	1,414	91,000
H	5	RANK HOVIS	1987	SEPT 87	1,544	117,500
D	7	RECKITT & COLMAN	1979	DEC 79	659	48,131
D	7	RECKITT & COLMAN	1980	DEC 80	728	53,170
D	7	RECKITT & COLMAN	1981	DEC 81	908	66,350
D	7	RECKITT & COLMAN	1982	JAN 83	901	76,340
D	7	RECKITT & COLMAN	1983	DEC 83	981	88,210
D	7	RECKITT & COLMAN	1984	DEC 84	1,124	101,450
D	7	RECKITT & COLMAN	1985	JAN 86	1,267	124,070
D	7	RECKITT & COLMAN	1986	JAN 87	1,329	142,430
D	7	RECKITT & COLMAN	1987	JAN 88	1,493	167,600

IND. CODE	COMPANY	YEAR	YEAR END	TURNOVER (m)	PRE-TAX PROFIT(000)
H 6	ROTHMANS INL B	1979	MAR 79	2,708	77,960
H 6	ROTHMANS INL B	1980	MAR 80	2,475	71,251
H 6	ROTHMANS INL B	1981	MAR 81	2,475	71,251
H 6	ROTHMANS INL B	1982	MAR 82	2,767	105,226
H 6	ROTHMANS INL B	1983	MAR 83	1,465	140,542
H 6	ROTHMANS INL B	1984	MAR 84	3,671	175,145
H 6	ROTHMANS INL B	1985	MAR 85	1,604	154,376
H 6	ROTHMANS INL B	1986	MAR 86	1,467	141,908
H 6	ROTHMANS INL B	1987	MAR 87	1,495	210,900
H 4	ROWN TREE	1979	DEC 79	601	29,955
H 4	ROWN TREE	1980	JAN 81	630	31,400
H 4	ROWN TREE	1981	JAN 82	688	39,900
H 4	ROWN TREE	1982	JAN 83	771	50,500
H 4	ROWN TREE	1983	DEC 83	952	61,400
H 4	ROWN TREE	1984	DEC 84	1,157	74,500
H 4	ROWN TREE	1985	DEC 85	1,205	79,300
H 4	ROWN TREE	1986	JAN 87	1,290	84,000
H 4	ROWN TREE	1987	JAN 88	1,428	112,100
I 1	SEARS	1979	JAN 79	884	63,687
I 1	SEARS	1980	JAN 80	1,258	90,629
I 1	SEARS	1981	JAN 81	1,384	99,706
I 1	SEARS	1982	JAN 82	1,491	104,000
I 1	SEARS	1983	JAN 83	1,597	110,100
I 1	SEARS	1984	JAN 84	1,846	155,900
I 1	SEARS	1985	JAN 85	2,019	168,500
I 1	SEARS	1986	JAN 86	2,278	177,800
I 1	SEARS	1987	JAN 87	2,480	207,500
B 2	THORN EMI	1979	MAR 79	1,127	47,686
B 2	THORN EMI	1980	MAR 80	1,621	68,578
B 2	THORN EMI	1981	MAR 81	2,229	94,300
B 2	THORN EMI	1982	MAR 82	2,436	105,400
B 2	THORN EMI	1983	MAR 83	2,716	122,000
B 2	THORN EMI	1984	MAR 84	2,821	156,825
B 2	THORN EMI	1985	MAR 85	3,204	123,425
B 2	THORN EMI	1986	MAR 86	3,317	124,100
B 2	THORN EMI	1987	MAR 87	3,185	132,100
F 2	TRUSTHOUSE FORTE	1979	OCT 79	712	60,870
F 2	TRUSTHOUSE FORTE	1980	OCT 80	772	66,000
F 2	TRUSTHOUSE FORTE	1981	OCT 81	833	52,300
F 2	TRUSTHOUSE FORTE	1982	OCT 82	907	53,100
F 2	TRUSTHOUSE FORTE	1983	OCT 83	963	69,300
F 2	TRUSTHOUSE FORTE	1984	OCT 84	1,131	96,000
F 2	TRUSTHOUSE FORTE	1985	OCT 85	1,245	121,800
F 2	TRUSTHOUSE FORTE	1986	OCT 86	1,477	131,500
F 2	TRUSTHOUSE FORTE	1987	OCT 87	1,778	165,000
H 3	UNILEVER	1979	DEC 79	10,249	577,465
H 3	UNILEVER	1980	DEC 80	10,152	572,000
H 3	UNILEVER	1981	DEC 81	11,889	709,200
H 3	UNILEVER	1982	DEC 82	13,216	761,500
H 3	UNILEVER	1983	DEC 83	13,386	813,000
H 3	UNILEVER	1984	DEC 84	16,172	995,000

IND. CODE	COMPANY	YEAR	YEAR END	TURNOVER (m)	PRE-TAX PROFIT(000)
H 3	UNILEVER	1985	DEC 85	16,693	978,000
H 3	UNILEVER	1986	DEC 86	17,140	1,186,000
H 3	UNILEVER	1987	DEC 87	16,550	1,327,000

IND. CODE	COMPANY	SHAREHOLDERS' FUND (m)	ROCE	OPERATING PROFIT	EMPLOYEES
H 1	ALLIED-LYONS				
H 1	ALLIED-LYONS	885			73,060
H 1	ALLIED-LYONS	887			72,589
H 1	ALLIED-LYONS	932			64,509
H 1	ALLIED-LYONS	979	0.139	0.065	62,643
H 1	ALLIED-LYONS	1210	0.131	0.069	71,204
H 1	ALLIED-LYONS	1302	0.134	0.069	71,448
H 1	ALLIED-LYONS	1858	0.126	0.080	70,301
H 1	ALLIED-LYONS	1697	0.117	0.091	
H 5	ASSD.BRIT FOODS				
H 5	ASSD.BRIT FOODS	409			72,031
H 5	ASSD.BRIT FOODS	461			73,689
H 5	ASSD.BRIT FOODS	543			72,419
H 5	ASSD.BRIT FOODS	628	0.176	0.049	68,518
H 5	ASSD.BRIT FOODS	786	0.150	0.040	
H 5	ASSD.BRIT FOODS	841	0.143	0.039	77,273
H 5	ASSD.BRIT FOODS	917	0.162	0.035	78,772
H 5	ASSD.BRIT FOODS	1477	0.122	0.055	
H 1	BASS	599			61,677
H 1	BASS	864			63,056
H 1	BASS	1023			74,604
H 1	BASS	1086	0.116	0.079	69,456
H 1	BASS	1155	0.136	0.089	71,207
H 1	BASS	1250	0.155	0.097	69,192
H 1	BASS	1380	0.167	0.104	71,260
H 1	BASS	1446	0.183	0.111	
H 1	BASS	2437	0.134	0.112	
H 6	BAT INDS.	1680			185,000
H 6	BAT INDS.	1746			177,000
H 6	BAT INDS.	2218			169,500
H 6	BAT INDS.	2721	0.221	0.069	178,000
H 6	BAT INDS.	3168	0.221	0.073	187,173
H 6	BAT INDS.	4276	0.211	0.081	212,822
H 6	BAT INDS.	3672	0.211	0.080	185,503
H 6	BAT INDS.	4168	0.218	0.080	
H 6	BAT INDS.				
D 7	BEECHAM GROUP	520			16,100
D 7	BEECHAM GROUP	558			16,800
D 7	BEECHAM GROUP	693			15,800
D 7	BEECHAM GROUP				
D 7	BEECHAM GROUP	747	0.293	0.142	35,400
D 7	BEECHAM GROUP	984	0.272	0.139	35,900
D 7	BEECHAM GROUP	1180	0.269	0.140	37,500
D 7	BEECHAM GROUP	1183	0.280	0.125	42,300
D 7	BEECHAM GROUP	1275	0.295	0.139	
A 5	BLUE CIRCLE IND	635			12,153
A 5	BLUE CIRCLE IND	744			12,852
A 5	BLUE CIRCLE IND	837			13,919
A 5	BLUE CIRCLE IND	855	0.110	0.105	12,508
A 5	BLUE CIRCLE IND	948	0.103	0.102	20,528
A 5	BLUE CIRCLE IND	1006	0.111	0.115	18,998

IND. CODE	COMPANY	SHAREHOLDERS' FUND (m)	ROCE	OPERATING PROFIT	EMPLOYEES
A 5	BLUE CIRCLE IND	961	0.108	0.094	17,127
A 5	BLUE CIRCLE IND	889	0.117	0.105	
A 5	BLUE CIRCLE IND				
G 6	BOOTS				
G 6	BOOTS	474			68,443
G 6	BOOTS	523			66,100
G 6	BOOTS	587			63,866
G 6	BOOTS	636	0.194		68,562
G 6	BOOTS	687	0.210		68,136
G 6	BOOTS	771	0.214		67,643
G 6	BOOTS	828	0.214		67,643
G 6	BOOTS	913	0.234		
A 3	BPB INDUSTRIES				
A 3	BPB INDUSTRIES	151			12,300
A 3	BPB INDUSTRIES	177			11,700
A 3	BPB INDUSTRIES	202			11,200
A 3	BPB INDUSTRIES	249	0.234	0.132	10,900
A 3	BPB INDUSTRIES	268	0.262	0.141	10,990
A 3	BPB INDUSTRIES	301	0.234	0.130	10,601
A 3	BPB INDUSTRIES	339	0.271	0.154	10,120
A 3	BPB INDUSTRIES	399	0.314	0.179	
D 8	BRIT. PETROLEUM	4994			113,000
D 8	BRIT. PETROLEUM	5925			118,200
D 8	BRIT. PETROLEUM	7725			153,250
D 8	BRIT. PETROLEUM	6478	0.149	0.078	163,000
D 8	BRIT. PETROLEUM	9638	0.153	0.069	131,600
D 8	BRIT. PETROLEUM	11543	0.157	0.077	130,100
D 8	BRIT. PETROLEUM	9908	0.192	0.072	129,450
D 8	BRIT. PETROLEUM	9960	0.068	0.020	
D 8	BRIT. PETROLEUM	10749	0.150	0.061	
E 9	COURTAULDS				
E 9	COURTAULDS	449			97,261
E 9	COURTAULDS	327			88,000
E 9	COURTAULDS	344			80,000
E 9	COURTAULDS	345	0.145	0.043	73,000
E 9	COURTAULDS	463	0.194	0.063	73,000
E 9	COURTAULDS	519	0.177	0.062	70,000
E 9	COURTAULDS	565	0.194	0.069	67,700
E 9	COURTAULDS	656	0.237	0.090	
I 2	ENG. CHINA CLAYS				
I 2	ENG. CHINA CLAYS	218			11,940
I 2	ENG. CHINA CLAYS	241			11,795
I 2	ENG. CHINA CLAYS	275	0.165	0.123	10,806
I 2	ENG. CHINA CLAYS	348	0.122	0.114	10,467
I 2	ENG. CHINA CLAYS	364	0.144	0.123	12,376
I 2	ENG. CHINA CLAYS	450	0.160	0.120	12,440
I 2	ENG. CHINA CLAYS	473	0.183	0.131	13,724
I 2	ENG. CHINA CLAYS	497	0.190	0.144	
D 7	GLAXO HLDGS	225			15,602
D 7	GLAXO HLDGS	338			14,816
D 7	GLAXO HLDGS	382			16,955

IND. CODE	COMPANY	SHAREHOLDERS' FUND (m)	ROCE	OPERATING PROFIT	EMPLOYEES
D 7	GLAXO HLDGS	438	0.263	0.144	28,406
D 7	GLAXO HLDGS	551	0.302	0.172	27,768
D 7	GLAXO HLDGS	683	0.318	0.184	25,053
D 7	GLAXO HLDGS	858	0.416	0.256	25,634
D 7	GLAXO HLDGS	1094	0.445	0.358	
D 7	GLAXO HLDGS	1453	0.429	0.381	
B 1	HAWKER SIDDELEY	467			56,600
B 1	HAWKER SIDDELEY	502			55,600
B 1	HAWKER SIDDELEY	578			52,700
B 1	HAWKER SIDDELEY	637	0.163	0.078	47,200
B 1	HAWKER SIDDELEY	776	0.140	0.086	43,300
B 1	HAWKER SIDDELEY	869	0.137	0.077	41,500
B 1	HAWKER SIDDELEY	816	0.144	0.084	40,800
B 1	HAWKER SIDDELEY	760	0.135	0.071	
B 1	HAWKER SIDDELEY				
A 3	PILKINGTON BROS	582			35,000
A 3	PILKINGTON BROS	736			40,300
A 3	PILKINGTON BROS	772			40,300
A 3	PILKINGTON BROS	866			39,300
A 3	PILKINGTON BROS	915	0.074	0.088	44,000
A 3	PILKINGTON BROS	946	0.089	0.091	44,000
A 3	PILKINGTON BROS	1086	0.105	0.105	44,300
A 3	PILKINGTON BROS	1041	0.930	0.081	
A 3	PILKINGTON BROS	891	0.175	0.127	
B 2	RACAL ELECTRONIC	128			6,724
B 2	RACAL ELECTRONIC	212			14,135
B 2	RACAL ELECTRONIC	265			12,662
B 2	RACAL ELECTRONIC	311			12,201
B 2	RACAL ELECTRONIC	311	0.268	0.158	18,112
B 2	RACAL ELECTRONIC	369	0.240	0.148	25,220
B 2	RACAL ELECTRONIC	436	0.199	0.131	32,525
B 2	RACAL ELECTRONIC	433	0.132	0.083	
B 2	RACAL ELECTRONIC	450	0.158	0.099	
H 5	RANK HOVIS				
H 5	RANK HOVIS	295			49,403
H 5	RANK HOVIS	318			45,826
H 5	RANK HOVIS	335	0.126	0.028	47,454
H 5	RANK HOVIS	319	0.128	0.031	42,577
H 5	RANK HOVIS	310	0.148	0.047	37,973
H 5	RANK HOVIS	324	0.182	0.057	35,433
H 5	RANK HOVIS	353	0.195	0.069	
H 5	RANK HOVIS	250	0.237	0.084	
D 7	RECKITT & COLMAN	196			16,000
D 7	RECKITT & COLMAN	201			15,000
D 7	RECKITT & COLMAN				
D 7	RECKITT & COLMAN	243	0.263	0.092	14,300
D 7	RECKITT & COLMAN	277	0.267	0.090	34,300
D 7	RECKITT & COLMAN	412	0.210	0.088	34,800
D 7	RECKITT & COLMAN	381	0.316	0.097	36,500
D 7	RECKITT & COLMAN	424	0.308	0.111	
D 7	RECKITT & COLMAN				

IND. CODE	COMPANY	SHAREHOLDERS' FUND (m)	ROCE	OPERATING PROFIT	EMPLOYEES
H 6	ROTHMANS INL B	272			24,686
H 6	ROTHMANS INL B	155			24,646
H 6	ROTHMANS INL B	233			22,898
H 6	ROTHMANS INL B	307			21,655
H 6	ROTHMANS INL B	441	0.196	0.088	25,017
H 6	ROTHMANS INL B	556	0.202	0.039	23,421
H 6	ROTHMANS INL B	459	0.164	0.063	21,833
H 6	ROTHMANS INL B	435	0.163	0.065	
H 6	ROTHMANS INL B	510	0.218	0.099	
H 4	ROWN TREE	226			31,000
H 4	ROWN TREE	243			30,000
H 4	ROWN TREE	320			28,000
H 4	ROWN TREE	346	0.133	0.073	28,800
H 4	ROWN TREE	346	0.149	0.076	31,200
H 4	ROWN TREE	390	0.155	0.081	32,400
H 4	ROWN TREE	372	0.172	0.084	52,000
H 4	ROWN TREE	389	0.155	0.082	
H 4	ROWN TREE	406	0.196	0.091	
I 1	SEARS				
I 1	SEARS	519			58,000
I 1	SEARS	544			57,000
I 1	SEARS	560			53,000
I 1	SEARS	710	0.147	0.070	51,000
I 1	SEARS	773	0.176	0.084	59,775
I 1	SEARS	857	0.173	0.077	60,571
I 1	SEARS	955	0.162	0.080	64,101
I 1	SEARS	1009	0.177	0.081	
B 2	THORN EMI				
B 2	THORN EMI	548			101,040
B 2	THORN EMI	577			90,894
B 2	THORN EMI	608			78,083
B 2	THORN EMI	540	0.171	0.059	73,559
B 2	THORN EMI	574	0.172	0.063	90,462
B 2	THORN EMI	559	0.138	0.051	90,327
B 2	THORN EMI	517	0.158	0.049	85,700
B 2	THORN EMI	566	0.172	0.046	
F 2	TRUSTHOUSE FORTE				
F 2	TRUSTHOUSE FORTE	347			72,000
F 2	TRUSTHOUSE FORTE	403			68,000
F 2	TRUSTHOUSE FORTE	574	0.097	0.085	66,000
F 2	TRUSTHOUSE FORTE	631	0.106	0.093	60,400
F 2	TRUSTHOUSE FORTE	814	0.105	0.101	57,800
F 2	TRUSTHOUSE FORTE	916	0.125	0.114	55,900
F 2	TRUSTHOUSE FORTE	1100	0.104	0.107	55,400
F 2	TRUSTHOUSE FORTE	1580	0.103	0.111	
H 3	UNILEVER	2144			85,486
H 3	UNILEVER	2160			79,148
H 3	UNILEVER	2569			73,252
H 3	UNILEVER	2901	0.176	0.056	69,233
H 3	UNILEVER	3096	0.175	0.060	264,000
H 3	UNILEVER	3348	0.174	0.061	277,000

IND. CODE	COMPANY	SHAREHOLDERS' FUND (m)	ROCE	OPERATING PROFIT	EMPLOYEES
H 3	UNILEVER	3316	0.178	0.059	312,000
H 3	UNILEVER	3713	0.132	0.070	
H 3	UNILEVER				

IND. CODE	COMPANY	HPD	MARKET VALUE (m)	SHARE PRICE (p)	DIVIDEND NET (p)
H 1	ALLIED-LYONS	65,000	47,134	78.5	4.40
H 1	ALLIED-LYONS	69,474	42,379	67.0	5.00
H 1	ALLIED-LYONS	86,745	44,991	71.0	5.00
H 1	ALLIED-LYONS	98,945	87,503	135.5	5.50
H 1	ALLIED-LYONS	89,856	90,636	138.0	6.05
H 1	ALLIED-LYONS	106,139	108,197	162.0	6.81
H 1	ALLIED-LYONS	124,916	182,190	268.0	7.50
H 1	ALLIED-LYONS	146,238	221,511	323.0	9.50
H 1	ALLIED-LYONS	293,225	248,813	343.0	11.40
H 5	ASSD.BRIT FOODS	35,415	31,211	79.1	2.35
H 5	ASSD.BRIT FOODS	40,000	45,252	114.6	3.09
H 5	ASSD.BRIT FOODS	45,000	51,049	129.1	3.45
H 5	ASSD.BRIT FOODS	50,000	57,177	143.6	3.91
H 5	ASSD.BRIT FOODS	55,000	56,536	142.0	4.27
H 5	ASSD.BRIT FOODS	57,460	81,421	204.0	5.00
H 5	ASSD.BRIT FOODS	60,000	103,772	260.0	5.40
H 5	ASSD.BRIT FOODS	67,000	124,307	312.0	6.10
H 5	ASSD.BRIT FOODS	85,000	134,076	300.0	7.30
H 1	BASS	56,077	5,337	192.0	7.80
H 1	BASS	66,077	66,213	208.0	8.60
H 1	BASS	78,327	66,255	207.0	9.46
H 1	BASS	90,077	96,528	300.0	10.10
H 1	BASS	102,144	99,491	308.0	11.36
H 1	BASS	112,162	156,943	483.0	12.90
H 1	BASS	105,652	214,808	658.0	14.70
H 1	BASS	125,904	239,945	735.0	17.00
H 1	BASS	146,292	278,015	825.0	19.55
H 6	BAT INDS.	94,726	80,049	59.5	4.47
H 6	BAT INDS.	116,336	88,330	60.8	4.75
H 6	BAT INDS.	137,906	129,405	89.0	5.75
H 6	BAT INDS.	169,888	227,912	156.8	6.88
H 6	BAT INDS.	150,112	261,214	179.0	8.25
H 6	BAT INDS.	200,371	515,202	351.0	10.30
H 6	BAT INDS.	226,830	464,030	315.0	12.10
H 6	BAT INDS.	223,918	682,784	462.0	14.30
H 6	BAT INDS.	224,079	656,100	440.0	16.90
D 7	BEECHAM GROUP	99,378	76,012	115.3	5.10
D 7	BEECHAM GROUP	103,192	117,416	177.3	6.03
D 7	BEECHAM GROUP	115,157	143,674	216.7	6.57
D 7	BEECHAM GROUP	129,142	222,515	334.9	6.88
D 7	BEECHAM GROUP	154,440	219,736	305.0	9.00
D 7	BEECHAM GROUP	171,660	281,139	390.0	10.20
D 7	BEECHAM GROUP	196,074	270,801	361.0	11.30
D 7	BEECHAM GROUP	146,026	331,540	440.0	12.00
D 7	BEECHAM GROUP	368,883	330,033	438.0	13.00
A 5	BLUE CIRCLE IND	63,173	19,599	117.8	6.09
A 5	BLUE CIRCLE IND	71,217	33,275	171.0	6.03
A 5	BLUE CIRCLE IND	81,868	53,835	253.0	6.57
A 5	BLUE CIRCLE IND	87,687	45,749	215.0	9.12
A 5	BLUE CIRCLE IND	101,396	49,104	211.5	9.50
A 5	BLUE CIRCLE IND	111,253	55,720	240.0	10.00

IND. CODE	COMPANY	HPD	MARKET VALUE (m)	SHARE PRICE (p)	DIVIDEND NET (p)
A 5	BLUE CIRCLE IND	114,733	73,728	287.5	10.50
A 5	BLUE CIRCLE IND	124,403	85,909	335.0	11.50
A 5	BLUE CIRCLE IND	151,830	110,529	430.0	15.00
G 6	BOOTS	37,511	58,204	80.5	3.00
G 6	BOOTS	56,000	86,892	120.0	3.50
G 6	BOOTS	60,000	71,324	98.5	3.75
G 6	BOOTS	69,000	91,503	126.0	4.25
G 6	BOOTS	81,000	130,904	180.0	4.75
G 6	BOOTS	99,000	143,550	197.0	5.50
G 6	BOOTS	124,000	190,372	261.0	6.20
G 6	BOOTS	148,000	209,588	228.0	7.10
G 6	BOOTS	163,000	217,438	263.0	8.00
A 3	BPB INDUSTRIES	32,239	14,369	38.8	1.65
A 3	BPB INDUSTRIES	45,966	20,487	55.3	2.25
A 3	BPB INDUSTRIES	54,801	30,485	81.5	2.25
A 3	BPB INDUSTRIES	58,389	50,040	132.8	2.63
A 3	BPB INDUSTRIES	71,227	52,474	138.0	3.00
A 3	BPB INDUSTRIES	78,954	53,234	140.0	3.50
A 3	BPB INDUSTRIES	92,140	68,063	179.0	3.80
A 3	BPB INDUSTRIES	106,000	100,954	265.5	4.50
A 3	BPB INDUSTRIES	134,000	104,650	258.0	12.50
D 8	BRIT. PETROLEUM	120,385	534,941	112.0	5.66
D 8	BRIT. PETROLEUM	143334	663,525	135.3	6.55
D 8	BRIT. PETROLEUM	158,151	574,060	105.3	6.75
D 8	BRIT. PETROLEUM	172,770	537,727	98.7	6.75
D 8	BRIT. PETROLEUM	183,134	740,304	135.3	8.00
D 8	BRIT. PETROLEUM	241,547	886,946	162.0	10.00
D 8	BRIT. PETROLEUM	260,972	1,020,051	186.0	11.33
D 8	BRIT. PETROLEUM	301,382	1,329,369	242.3	12.00
D 8	BRIT. PETROLEUM	347,212	1,502,477	252.0	12.50
E 9	COURTAULDS	84368	19,673	69.1	8.10
E 9	COURTAULDS	65,623	15,302	53.8	8.22
E 9	COURTAULDS	62,000	20,493	72.0	0.96
E 9	COURTAULDS	75,000	20,220	71.0	2.88
E 9	COURTAULDS	77,750	44,814	123.0	3.10
E 9	COURTAULDS	99,052	48,554	128.0	4.20
E 9	COURTAULDS	113,521	72,837	192.0	5.00
E 9	COURTAULDS	126,288	116,083	306.0	6.50
E 9	COURTAULDS	171,879	129,222	333.0	9.50
I 2	ENG. CHINA CLAYS	40,829	12,345	74.8	4.89
I 2	ENG. CHINA CLAYS	48,324	14,362	87.0	5.86
I 2	ENG. CHINA CLAYS	51,224	24,795	149.6	7.04
I 2	ENG. CHINA CLAYS	64,371	33,401	161.3	8.01
I 2	ENG. CHINA CLAYS	67,590	41,675	201.4	8.75
I 2	ENG. CHINA CLAYS	79,098	56,755	251.2	9.60
I 2	ENG. CHINA CLAYS	92,074	62,431	280.0	11.60
I 2	ENG. CHINA CLAYS	97,426	81,632	308.0	12.50
I 2	ENG. CHINA CLAYS	110,275	98,753	386.0	14.50
D 7	GLAXO HLDGS	73,180	36,774	54.4	2.00
D 7	GLAXO HLDGS	88,042	45,711	67.5	2.38
D 7	GLAXO HLDGS	64,277	72,893	106.0	2.81

IND. CODE	COMPANY	HPD	MARKET VALUE (m)	SHARE PRICE (p)	DIVIDEND NET (p)
D 7	GLAXO HLDGS	86,809	229,269	313.3	3.50
D 7	GLAXO HLDGS	105,066	258,436	351.0	4.50
D 7	GLAXO HLDGS	141,833	404,957	550.0	6.50
D 7	GLAXO HLDGS	162,213	569,936	770.0	10.00
D 7	GLAXO HLDGS	243,614	777,185	1,050.0	14.00
D 7	GLAXO HLDGS	308,724	729,073	985.0	19.00
B 1	HAWKER SIDDELEY	71,218	35,471	180.0	8.00
B 1	HAWKER SIDDELEY	73,554	50,447	256.0	8.20
B 1	HAWKER SIDDELEY	91,169	64,241	326.0	9.30
B 1	HAWKER SIDDELEY	98,664	66,211	336.0	9.80
B 1	HAWKER SIDDELEY	104,694	69,758	354.0	11.00
B 1	HAWKER SIDDELEY	136,097	84,538	429.0	11.80
B 1	HAWKER SIDDELEY	107,497	90,843	461.0	14.50
B 1	HAWKER SIDDELEY	106,345	87,493	444.0	15.00
B 1	HAWKER SIDDELEY	114,106	87,689	445.0	18.50
A 3	PILKINGTON BROS	47,994	311	64.8	2.55
A 3	PILKINGTON BROS	63,585	444	85.9	3.40
A 3	PILKINGTON BROS	71,949	441	85.2	3.39
A 3	PILKINGTON BROS	79,169	257	49.6	3.39
A 3	PILKINGTON BROS	81,919	374	71.6	3.39
A 3	PILKINGTON BROS	85,457	645	101.0	3.72
A 3	PILKINGTON BROS	103,457	693	108.7	4.12
A 3	PILKINGTON BROS	114,428	1,413	221.0	4.50
A 3	PILKINGTON BROS	177,137	1,635	223.0	7.33
B 2	RACAL ELECTRONIC	56,960	419	91.0	1.88
B 2	RACAL ELECTRONIC	103,592	883	165.5	2.06
B 2	RACAL ELECTRONIC	117,476	1,163	218.0	2.27
B 2	RACAL ELECTRONIC	127,542	1,596	298.5	2.50
B 2	RACAL ELECTRONIC	148,267	1,133	212.0	2.75
B 2	RACAL ELECTRONIC	152,117	1,495	262.0	2.89
B 2	RACAL ELECTRONIC	178,117	913	160.0	3.03
B 2	RACAL ELECTRONIC	194,113	1,101	193.0	3.03
B 2	RACAL ELECTRONIC	204,212	1,372	220.0	3.30
H 5	RANK HOVIS	57,095	123	42.0	3.75
H 5	RANK HOVIS	58,454	118	43.0	3.64
H 5	RANK HOVIS	65,264	165	60.0	3.86
H 5	RANK HOVIS	71,387	147	53.0	3.86
H 5	RANK HOVIS	78,000	215	77.0	4.00
H 5	RANK HOVIS	93,000	386	138.0	4.40
H 5	RANK HOVIS	105,000	484	172.0	5.30
H 5	RANK HOVIS	134,000	822	284.0	6.60
H 5	RANK HOVIS	173,000	1,125	332.0	8.50
D 7	RECKITT & COLMAN	67,724	232	181.7	8.21
D 7	RECKITT & COLMAN	76,989	230	179.7	8.21
D 7	RECKITT & COLMAN	80,167	309	241.6	9.47
D 7	RECKITT & COLMAN	83,344	464	363.3	10.39
D 7	RECKITT & COLMAN	98,175	547	428.1	11.98
D 7	RECKITT & COLMAN	109,856	842	568.0	13.82
D 7	RECKITT & COLMAN	122,807	965	651.0	16.00
D 7	RECKITT & COLMAN	140,544	1,278	862.0	25.60
D 7	RECKITT & COLMAN	162,336	1,164	785.0	21.70

IND. CODE	COMPANY	HPD	MARKET VALUE (m)	SHARE PRICE (p)	DIVIDEND NET (p)
H 6	ROTHMANS INL B	60,068	64	46.5	2.45
H 6	ROTHMANS INL B	54,901	59	42.5	3.11
H 6	ROTHMANS INL B	54,901	104	75.0	3.65
H 6	ROTHMANS INL B	67,890	160	115.0	4.40
H 6	ROTHMANS INL B	115,349	164	118.0	5.30
H 6	ROTHMANS INL B	136,542	395	182.0	6.00
H 6	ROTHMANS INL B	152,637	313	133.0	6.40
H 6	ROTHMANS INL B	229,961	441	179.0	6.70
H 6	ROTHMANS INL B	230,487	1,112	375.0	7.70
H 4	ROWN TREE	43,000	143	153.7	6.96
H 4	ROWN TREE	54,000	167	147.9	6.96
H 4	ROWN TREE	58,000	225	163.4	7.87
H 4	ROWN TREE	66,000	285	200.8	8.66
H 4	ROWN TREE	75,000	342	212.6	9.75
H 4	ROWN TREE	87,000	614	377.0	11.00
H 4	ROWN TREE	103,000	689	401.6	12.20
H 4	ROWN TREE	113,000	658	403.0	13.60
H 4	ROWN TREE	138,000	961	447.0	15.50
I 1	SEARS	25,474	350	26.0	0.96
I 1	SEARS	36,250	498	37.0	1.33
I 1	SEARS	51,861	489	36.3	1.53
I 1	SEARS	60,829	915	68.0	1.57
I 1	SEARS	76,652	1,097	81.5	1.87
I 1	SEARS	104,959	1,231	91.5	2.50
I 1	SEARS	121,250	1,617	109.5	3.00
I 1	SEARS	153,795	1,836	123.0	3.40
I 1	SEARS	164,398	1,941	130.0	4.00
B 2	THORN EMI	51,922	390	267.2	12.77
B 2	THORN EMI	74,669	560	316.3	14.37
B 2	THORN EMI	96,961	798	449.9	14.37
B 2	THORN EMI	108,412	756	425.4	14.37
B 2	THORN EMI	115,213	1,142	642.5	15.47
B 2	THORN EMI	146,909	1,031	484.0	17.19
B 2	THORN EMI	152,475	861	401.0	17.19
B 2	THORN EMI	150,919	1,016	470.0	17.19
B 2	THORN EMI	185,444	1,453	535.0	18.17
F 2	TRUSTHOUSE FORTE	53,499	274	43.6	2.57
F 2	TRUSTHOUSE FORTE	62,604	404	62.9	2.89
F 2	TRUSTHOUSE FORTE	66,905	464	59.5	2.97
F 2	TRUSTHOUSE FORTE	70,616	624	80.0	3.50
F 2	TRUSTHOUSE FORTE	87,316	729	93.5	4.10
F 2	TRUSTHOUSE FORTE	99,905	1,138	146.0	4.70
F 2	TRUSTHOUSE FORTE	105,000	1,224	157.0	5.40
F 2	TRUSTHOUSE FORTE	125,000	1,399	179.0	6.00
F 2	TRUSTHOUSE FORTE	234,577	1,700	217.0	7.10
H 3	UNILEVER	70,490	827	90.4	4.81
H 3	UNILEVER	67,333	838	91.6	4.58
H 3	UNILEVER	78,367	1,113	121.6	5.37
H 3	UNILEVER	95,115	1,410	154.0	5.77
H 3	UNILEVER	108,055	1,638	179.0	6.17
H 3	UNILEVER	119,939	1,731	219.0	7.10

IND. CODE	COMPANY	HPD	MARKET VALUE (m)	SHARE PRICE (p)	DIVIDEND NET (p)
H 3	UNILEVER	146,338	2,181	276.0	7.10
H 3	UNILEVER	142,528	3,446	436.0	7.72
H 3	UNILEVER	165,472	3,741	465.0	11.80

IND. CODE	COMPANY	NET EARNINGS SHARE(p)	RETURN ON SALES	RETURN ON EQUITY
H 1	ALLIED-LYONS		0.06	
H 1	ALLIED-LYONS		0.05	0.12
H 1	ALLIED-LYONS		0.05	0.13
H 1	ALLIED-LYONS		0.06	0.15
H 1	ALLIED-LYONS	13.63	0.05	0.15
H 1	ALLIED-LYONS	16.67	0.06	0.15
H 1	ALLIED-LYONS	16.37	0.06	0.15
H 1	ALLIED-LYONS	20.93	0.07	0.13
H 1	ALLIED-LYONS	28.23	0.08	0.18
H 5	ASSD.BRIT FOODS		0.04	
H 5	ASSD.BRIT FOODS		0.04	0.23
H 5	ASSD.BRIT FOODS		0.04	0.25
H 5	ASSD.BRIT FOODS		0.05	0.26
H 5	ASSD.BRIT FOODS	20.94	0.04	0.23
H 5	ASSD.BRIT FOODS	21.21	0.05	0.16
H 5	ASSD.BRIT FOODS	19.80	0.05	0.16
H 5	ASSD.BRIT FOODS	24.66	0.05	0.18
H 5	ASSD.BRIT FOODS	29.62	0.09	0.13
H 1	BASS		0.09	0.17
H 1	BASS		0.09	0.13
H 1	BASS		0.08	0.13
H 1	BASS	25.05	0.07	0.11
H 1	BASS	30.98	0.08	0.14
H 1	BASS	41.41	0.09	0.17
H 1	BASS	48.25	0.10	0.18
H 1	BASS	54.89	0.11	0.20
H 1	BASS	67.18	0.11	0.14
H 6	BAT INDS.		0.06	0.27
H 6	BAT INDS.		0.06	0.27
H 6	BAT INDS.		0.07	0.31
H 6	BAT INDS.	31.21	0.08	0.31
H 6	BAT INDS.	37.57	0.08	0.31
H 6	BAT INDS.	53.55	0.10	0.33
H 6	BAT INDS.	45.78	0.09	0.32
H 6	BAT INDS.	51.57	0.10	0.33
H 6	BAT INDS.		0.08	
D 7	BEECHAM GROUP		0.13	0.24
D 7	BEECHAM GROUP		0.13	0.23
D 7	BEECHAM GROUP		0.13	0.22
D 7	BEECHAM GROUP		0.14	
D 7	BEECHAM GROUP	22.56	0.14	0.32
D 7	BEECHAM GROUP	22.75	0.14	0.27
D 7	BEECHAM GROUP	23.87	0.13	0.26
D 7	BEECHAM GROUP	23.15	0.12	0.26
D 7	BEECHAM GROUP	27.08	0.13	0.27
A 5	BLUE CIRCLE IND		0.12	0.10
A 5	BLUE CIRCLE IND		0.12	0.11
A 5	BLUE CIRCLE IND		0.14	0.12
A 5	BLUE CIRCLE IND	32.32	0.11	0.11
A 5	BLUE CIRCLE IND	30.85	0.12	0.12
A 5	BLUE CIRCLE IND	33.64	0.13	0.11

IND. CODE	COMPANY	NET EARNINGS SHARE(p)	RETURN ON SALES	RETURN ON EQUITY
A 5	BLUE CIRCLE IND	32.98	0.12	0.12
A 5	BLUE CIRCLE IND	38.71	0.12	0.14
A 5	BLUE CIRCLE IND		0.15	
G 6	BOOTS		0.09	
G 6	BOOTS		0.09	0.22
G 6	BOOTS		0.09	0.23
G 6	BOOTS		0.08	0.21
G 6	BOOTS	10.74	0.08	0.20
G 6	BOOTS	12.93	0.08	0.23
G 6	BOOTS	13.43	0.09	0.23
G 6	BOOTS	15.52	0.09	0.23
G 6	BOOTS	16.96	0.09	0.24
A 3	BPB INDUSTRIES		0.12	
A 3	BPB INDUSTRIES		0.12	0.26
A 3	BPB INDUSTRIES		0.12	0.24
A 3	BPB INDUSTRIES		0.14	0.28
A 3	BPB INDUSTRIES	11.22	0.14	0.26
A 3	BPB INDUSTRIES	14.01	0.15	0.30
A 3	BPB INDUSTRIES	12.50	0.14	0.26
A 3	BPB INDUSTRIES	16.96	0.17	0.30
A 3	BPB INDUSTRIES	46.15	0.19	0.36
D 8	BRIT. PETROLEUM		0.19	0.86
D 8	BRIT. PETROLEUM		0.19	0.82
D 8	BRIT. PETROLEUM		0.08	0.31
D 8	BRIT. PETROLEUM	13.12	0.08	0.36
D 8	BRIT. PETROLEUM	15.82	0.07	0.27
D 8	BRIT. PETROLEUM	25.59	0.08	0.30
D 8	BRIT. PETROLEUM	29.14	0.08	0.36
D 8	BRIT. PETROLEUM	10.41	0.03	0.10
D 8	BRIT. PETROLEUM	24.91	0.07	0.22
E 9	COURTAULDS		0.02	
E 9	COURTAULDS		0.02	0.09
E 9	COURTAULDS		0.00	0.02
E 9	COURTAULDS		0.03	0.15
E 9	COURTAULDS	11.03	0.03	0.18
E 9	COURTAULDS	21.26	0.06	0.25
E 9	COURTAULDS	23.91	0.06	0.25
E 9	COURTAULDS	29.74	0.07	0.25
E 9	COURTAULDS	38.03	0.09	
I 2	ENG. CHINA CLAYS		0.12	
I 2	ENG. CHINA CLAYS		0.12	0.19
I 2	ENG. CHINA CLAYS		0.12	0.17
I 2	ENG. CHINA CLAYS	21.13	0.11	0.16
I 2	ENG. CHINA CLAYS	16.97	0.09	0.13
I 2	ENG. CHINA CLAYS	23.46	0.11	0.18
I 2	ENG. CHINA CLAYS	25.10	0.10	0.17
I 2	ENG. CHINA CLAYS	27.80	0.13	0.19
I 2	ENG. CHINA CLAYS	34.03	0.14	0.22
D 7	GLAXO HLDGS		0.12	0.29
D 7	GLAXO HLDGS		0.12	0.22
D 7	GLAXO HLDGS		0.12	0.23

IND. CODE	COMPANY	NET EARNINGS SHARE(p)	RETURN ON SALES	RETURN ON EQUITY
D 7	GLAXO HLDGS	11.60	0.15	0.31
D 7	GLAXO HLDGS	15.38	0.19	0.35
D 7	GLAXO HLDGS	23.31	0.22	0.38
D 7	GLAXO HLDGS	37.56	0.28	0.47
D 7	GLAXO HLDGS	47.58	0.40	0.52
D 7	GLAXO HLDGS	67.55	0.43	0.52
B 1	HAWKER SIDDELEY		0.10	0.23
B 1	HAWKER SIDDELEY		0.09	0.23
B 1	HAWKER SIDDELEY		0.09	0.21
B 1	HAWKER SIDDELEY	40.55	0.09	0.19
B 1	HAWKER SIDDELEY	45.16	0.10	0.19
B 1	HAWKER SIDDELEY	45.57	0.10	0.18
B 1	HAWKER SIDDELEY	45.36	0.10	0.19
B 1	HAWKER SIDDELEY	2.00	0.09	0.19
B 1	HAWKER SIDDELEY		0.09	
A 3	PILKINGTON BROS		0.10	0.08
A 3	PILKINGTON BROS		0.10	0.09
A 3	PILKINGTON BROS		0.10	0.10
A 3	PILKINGTON BROS		0.06	0.06
A 3	PILKINGTON BROS	4.63	0.07	0.08
A 3	PILKINGTON BROS	4.72	0.08	0.11
A 3	PILKINGTON BROS	9.53	0.11	0.12
A 3	PILKINGTON BROS	6.58	0.09	0.12
A 3	PILKINGTON BROS	25.56	0.13	0.30
B 2	RACAL ELECTRONIC		0.14	0.15
B 2	RACAL ELECTRONIC		0.14	0.17
B 2	RACAL ELECTRONIC		0.14	0.28
B 2	RACAL ELECTRONIC		0.16	0.33
B 2	RACAL ELECTRONIC	13.28	0.15	0.37
B 2	RACAL ELECTRONIC	14.81	0.15	0.32
B 2	RACAL ELECTRONIC	15.54	0.12	0.30
B 2	RACAL ELECTRONIC	9.25	0.06	0.19
B 2	RACAL ELECTRONIC	11.62	0.08	0.23
H 5	RANK HOVIS		0.02	
H 5	RANK HOVIS		0.02	0.12
H 5	RANK HOVIS		0.02	0.14
H 5	RANK HOVIS	8.55	0.02	0.10
H 5	RANK HOVIS	9.87	0.02	0.13
H 5	RANK HOVIS	12.67	0.04	0.17
H 5	RANK HOVIS	15.57	0.05	0.22
H 5	RANK HOVIS	20.76	0.06	0.26
H 5	RANK HOVIS	24.24	0.08	0.47
D 7	RECKITT & COLMAN		0.07	0.25
D 7	RECKITT & COLMAN		0.07	0.26
D 7	RECKITT & COLMAN		0.07	
D 7	RECKITT & COLMAN	33.72	0.08	0.31
D 7	RECKITT & COLMAN	36.42	0.09	0.32
D 7	RECKITT & COLMAN	36.89	0.09	0.25
D 7	RECKITT & COLMAN	48.68	0.10	0.33
D 7	RECKITT & COLMAN	56.02	0.11	
D 7	RECKITT & COLMAN	68.10	0.11	

IND. CODE	COMPANY	NET EARNINGS SHARE(p)	RETURN ON SALES	RETURN ON EQUITY
H 6	ROTHMANS INL B		0.03	0.29
H 6	ROTHMANS INL B		0.03	0.46
H 6	ROTHMANS INL B		0.03	0.31
H 6	ROTHMANS INL B		0.04	0.34
H 6	ROTHMANS INL B	45.04	0.10	0.32
H 6	ROTHMANS INL B	45.85	0.05	0.32
H 6	ROTHMANS INL B	30.16	0.10	0.34
H 6	ROTHMANS INL B	29.05	0.10	0.33
H 6	ROTHMANS INL B	38.16	0.14	0.41
H 4	ROWN TREE		0.05	0.13
H 4	ROWN TREE		0.05	0.13
H 4	ROWN TREE		0.06	0.12
H 4	ROWN TREE	24.46	0.07	0.15
H 4	ROWN TREE	30.38	0.06	0.18
H 4	ROWN TREE	34.86	0.06	0.19
H 4	ROWN TREE	35.47	0.07	0.21
H 4	ROWN TREE	34.97	0.07	0.22
H 4	ROWN TREE	41.07	0.08	0.28
I 1	SEARS		0.07	
I 1	SEARS		0.07	0.17
I 1	SEARS		0.07	0.18
I 1	SEARS		0.07	0.19
I 1	SEARS	4.73	0.07	0.16
I 1	SEARS	6.87	0.08	0.20
I 1	SEARS	7.62	0.08	0.20
I 1	SEARS	7.77	0.08	0.19
I 1	SEARS	8.68	0.08	0.21
B 2	THORN EMI		0.04	
B 2	THORN EMI		0.04	0.13
B 2	THORN EMI		0.04	0.16
B 2	THORN EMI		0.04	0.17
B 2	THORN EMI	34.79	0.04	0.23
B 2	THORN EMI	44.61	0.06	0.27
B 2	THORN EMI	33.90	0.04	0.22
B 2	THORN EMI	34.29	0.04	0.24
B 2	THORN EMI	28.94	0.04	0.23
F 2	TRUSTHOUSE FORTE		0.09	
F 2	TRUSTHOUSE FORTE		0.09	0.19
F 2	TRUSTHOUSE FORTE		0.06	0.13
F 2	TRUSTHOUSE FORTE	5.49	0.06	0.09
F 2	TRUSTHOUSE FORTE	6.33	0.07	0.11
F 2	TRUSTHOUSE FORTE	8.25	0.08	0.12
F 2	TRUSTHOUSE FORTE	10.11	0.10	0.13
F 2	TRUSTHOUSE FORTE	11.84	0.09	0.12
F 2	TRUSTHOUSE FORTE	14.42	0.09	0.10
H 3	UNILEVER		0.06	0.27
H 3	UNILEVER		0.06	0.26
H 3	UNILEVER		0.06	0.28
H 3	UNILEVER	22.14	0.06	0.26
H 3	UNILEVER	20.60	0.06	0.26
H 3	UNILEVER	27.78	0.06	0.30

IND. CODE	COMPANY	NET EARNINGS SHARE(p)	RETURN ON SALES	RETURN ON EQUITY
H 3	UNILEVER	28.34	0.06	0.29
H 3	UNILEVER	34.97	0.07	0.32
H 3	UNILEVER		0.08	

IND. CODE	COMPANY	% GROWTH IN EQUITY	EQUITY INDEX	CUM.GROWTH IN EQUITY
H 1	ALLIED-LYONS			
H 1	ALLIED-LYONS			
H 1	ALLIED-LYONS	0.00	(0.10)	(0.10)
H 1	ALLIED-LYONS	0.05	(0.03)	(0.14)
H 1	ALLIED-LYONS	0.05	0.00	(0.13)
H 1	ALLIED-LYONS	0.24	0.18	0.05
H 1	ALLIED-LYONS	0.08	0.01	0.06
H 1	ALLIED-LYONS	0.43	0.38	0.44
H 1	ALLIED-LYONS	(0.09)	(0.12)	0.32
H 5	ASSD.BRIT FOODS			
H 5	ASSD.BRIT FOODS			
H 5	ASSD.BRIT FOODS	0.13	0.01	0.01
H 5	ASSD.BRIT FOODS	0.18	0.08	0.09
H 5	ASSD.BRIT FOODS	0.16	0.11	0.20
H 5	ASSD.BRIT FOODS	0.25	0.19	0.39
H 5	ASSD.BRIT FOODS	0.07	0.01	0.40
H 5	ASSD.BRIT FOODS	0.09	0.05	0.45
H 5	ASSD.BRIT FOODS	0.61	0.55	1.00
H 1	BASS			
H 1	BASS	0.44	0.23	0.23
H 1	BASS	0.18	0.06	0.28
H 1	BASS	0.06	(0.02)	0.26
H 1	BASS	0.06	0.02	0.28
H 1	BASS	0.08	0.03	0.31
H 1	BASS	0.10	0.04	0.35
H 1	BASS	0.05	0.01	0.36
H 1	BASS	0.69	0.62	0.98
H 6	BAT INDS.			
H 6	BAT INDS.	0.04	(0.12)	(0.12)
H 6	BAT INDS.	0.27	0.14	0.02
H 6	BAT INDS.	0.23	0.13	0.15
H 6	BAT INDS.	0.16	0.11	0.26
H 6	BAT INDS.	0.35	0.29	0.55
H 6	BAT INDS.	(0.14)	(0.19)	0.36
H 6	BAT INDS.	0.14	0.10	0.45
H 6	BAT INDS.			
D 7	BEECHAM GROUP			
D 7	BEECHAM GROUP	0.07	(0.09)	(0.09)
D 7	BEECHAM GROUP	0.24	0.11	0.02
D 7	BEECHAM GROUP			
D 7	BEECHAM GROUP			
D 7	BEECHAM GROUP	0.32	0.26	0.26
D 7	BEECHAM GROUP	0.20	0.13	0.39
D 7	BEECHAM GROUP	0.00	(0.03)	0.36
D 7	BEECHAM GROUP	0.08	0.03	0.39
A 5	BLUE CIRCLE IND			
A 5	BLUE CIRCLE IND	0.17	(0.00)	(0.00)
A 5	BLUE CIRCLE IND	0.13	0.01	0.00
A 5	BLUE CIRCLE IND	0.02	(0.06)	(0.06)
A 5	BLUE CIRCLE IND	0.11	0.06	0.00
A 5	BLUE CIRCLE IND	0.06	0.01	0.01

IND. CODE	COMPANY	% GROWTH IN EQUITY	EQUITY INDEX	CUM.GROWTH IN EQUITY
A 5	BLUE CIRCLE IND	(0.04)	(0.10)	(0.09)
A 5	BLUE CIRCLE IND	(0.07)	(0.10)	(0.19)
A 5	BLUE CIRCLE IND			
G 6	BOOTS			
G 6	BOOTS			
G 6	BOOTS	0.10	(0.01)	(0.01)
G 6	BOOTS	0.12	0.03	0.02
G 6	BOOTS	0.08	0.03	0.05
G 6	BOOTS	0.08	0.03	0.09
G 6	BOOTS	0.12	0.06	0.14
G 6	BOOTS	0.07	0.04	0.18
G 6	BOOTS	0.10	0.06	0.24
A 3	BPB INDUSTRIES			
A 3	BPB INDUSTRIES			
A 3	BPB INDUSTRIES	0.17	0.05	0.05
A 3	BPB INDUSTRIES	0.14	0.05	0.10
A 3	BPB INDUSTRIES	0.23	0.18	0.28
A 3	BPB INDUSTRIES	0.08	0.03	0.30
A 3	BPB INDUSTRIES	0.12	0.06	0.36
A 3	BPB INDUSTRIES	0.12	0.09	0.45
A 3	BPB INDUSTRIES	0.18	0.13	0.58
D 8	BRIT. PETROLEUM			
D 8	BRIT. PETROLEUM	0.19	0.01	0.01
D 8	BRIT. PETROLEUM	0.30	0.17	0.17
D 8	BRIT. PETROLEUM	(0.16)	(0.23)	(0.05)
D 8	BRIT. PETROLEUM	0.49	0.42	0.37
D 8	BRIT. PETROLEUM	0.20	0.14	0.51
D 8	BRIT. PETROLEUM	(0.14)	(0.19)	0.32
D 8	BRIT. PETROLEUM	0.01	(0.03)	0.29
D 8	BRIT. PETROLEUM	0.08	0.04	0.33
E 9	COURTAULDS			
E 9	COURTAULDS			
E 9	COURTAULDS	(0.27)	(0.35)	(0.35)
E 9	COURTAULDS	0.05	(0.03)	(0.38)
E 9	COURTAULDS	0.00	(0.04)	(0.42)
E 9	COURTAULDS	0.34	0.28	(0.14)
E 9	COURTAULDS	0.12	0.06	(0.09)
E 9	COURTAULDS	0.09	0.05	(0.03)
E 9	COURTAULDS	0.16	0.11	0.08
I 2	ENG. CHINA CLAYS			
I 2	ENG. CHINA CLAYS			
I 2	ENG. CHINA CLAYS	0.11	(0.01)	(0.01)
I 2	ENG. CHINA CLAYS	0.14	0.05	0.04
I 2	ENG. CHINA CLAYS	0.27	0.21	0.25
I 2	ENG. CHINA CLAYS	0.04	(0.00)	0.24
I 2	ENG. CHINA CLAYS	0.24	0.17	0.41
I 2	ENG. CHINA CLAYS	0.05	0.02	0.43
I 2	ENG. CHINA CLAYS	0.05	0.01	0.44
D 7	GLAXO HLDGS			
D 7	GLAXO HLDGS	0.50	0.28	0.28
D 7	GLAXO HLDGS	0.13	0.01	0.29

IND. CODE	COMPANY	% GROWTH IN EQUITY	EQUITY INDEX	CUM.GROWTH IN EQUITY
D 7	GLAXO HLDGS	0.15	0.06	0.34
D 7	GLAXO HLDGS	0.26	0.20	0.54
D 7	GLAXO HLDGS	0.24	0.18	0.73
D 7	GLAXO HLDGS	0.26	0.18	0.91
D 7	GLAXO HLDGS	0.27	0.23	1.14
D 7	GLAXO HLDGS	0.33	0.27	1.42
B 1	HAWKER SIDDELEY			
B 1	HAWKER SIDDELEY	0.07	(0.09)	(0.09)
B 1	HAWKER SIDDELEY	0.15	0.03	(0.06)
B 1	HAWKER SIDDELEY	0.10	0.02	(0.04)
B 1	HAWKER SIDDELEY	0.22	0.16	0.12
B 1	HAWKER SIDDELEY	0.12	0.07	0.19
B 1	HAWKER SIDDELEY	(0.06)	(0.12)	0.07
B 1	HAWKER SIDDELEY	(0.07)	(0.10)	(0.02)
B 1	HAWKER SIDDELEY			
A 3	PILKINGTON BROS			
A 3	PILKINGTON BROS	0.26	0.07	0.07
A 3	PILKINGTON BROS	0.05	(0.06)	0.01
A 3	PILKINGTON BROS	0.12	0.03	0.05
A 3	PILKINGTON BROS	0.06	0.01	0.05
A 3	PILKINGTON BROS	0.03	(0.01)	0.04
A 3	PILKINGTON BROS	0.15	0.08	0.12
A 3	PILKINGTON BROS	(0.04)	(0.07)	0.05
A 3	PILKINGTON BROS	(0.14)	(0.18)	(0.13)
B 2	RACAL ELECTRONIC			
B 2	RACAL ELECTRONIC	0.66	0.41	0.41
B 2	RACAL ELECTRONIC	0.25	0.12	0.52
B 2	RACAL ELECTRONIC	0.17	0.08	0.61
B 2	RACAL ELECTRONIC	0.00	(0.04)	0.56
B 2	RACAL ELECTRONIC	0.18	0.13	0.69
B 2	RACAL ELECTRONIC	0.18	0.11	0.81
B 2	RACAL ELECTRONIC	(0.01)	(0.04)	0.77
B 2	RACAL ELECTRONIC	0.04	(0.00)	0.76
H 5	RANK HOVIS			
H 5	RANK HOVIS			
H 5	RANK HOVIS	0.08	(0.04)	(0.04)
H 5	RANK HOVIS	0.05	(0.03)	(0.07)
H 5	RANK HOVIS	(0.05)	(0.09)	(0.16)
H 5	RANK HOVIS	(0.03)	(0.08)	(0.23)
H 5	RANK HOVIS	0.04	(0.02)	(0.25)
H 5	RANK HOVIS	0.09	0.06	(0.19)
H 5	RANK HOVIS	(0.29)	(0.32)	(0.51)
D 7	RECKITT & COLMAN			
D 7	RECKITT & COLMAN	0.03	(0.13)	(0.13)
D 7	RECKITT & COLMAN			
D 7	RECKITT & COLMAN			
D 7	RECKITT & COLMAN	0.14	0.09	0.09
D 7	RECKITT & COLMAN	0.49	0.42	0.51
D 7	RECKITT & COLMAN	(0.08)	(0.13)	0.38
D 7	RECKITT & COLMAN	0.11	0.08	0.46
D 7	RECKITT & COLMAN			

IND. CODE	COMPANY	% GROWTH IN EQUITY	EQUITY INDEX	CUM.GROWTH IN EQUITY
H 6	ROTHMANS INL B			
H 6	ROTHMANS INL B	(0.43)	(0.52)	(0.52)
H 6	ROTHMANS INL B	0.50	0.34	(0.17)
H 6	ROTHMANS INL B	0.32	0.21	0.04
H 6	ROTHMANS INL B	0.44	0.37	0.41
H 6	ROTHMANS INL B	0.26	0.20	0.62
H 6	ROTHMANS INL B	(0.17)	(0.22)	0.39
H 6	ROTHMANS INL B	(0.05)	(0.08)	0.31
H 6	ROTHMANS INL B	0.17	0.13	0.44
H 4	ROWN TREE			
H 4	ROWN TREE	0.08	(0.09)	(0.09)
H 4	ROWN TREE	0.32	0.18	0.09
H 4	ROWN TREE	0.08	(0.01)	0.09
H 4	ROWN TREE	0.00	(0.04)	0.04
H 4	ROWN TREE	0.13	0.07	0.12
H 4	ROWN TREE	(0.05)	(0.10)	0.01
H 4	ROWN TREE	0.05	0.01	0.03
H 4	ROWN TREE	0.04	0.00	0.03
I 1	SEARS			
I 1	SEARS			
I 1	SEARS	0.05	(0.06)	(0.06)
I 1	SEARS	0.03	(0.05)	(0.12)
I 1	SEARS	0.27	0.21	0.10
I 1	SEARS	0.09	0.04	0.13
I 1	SEARS	0.11	0.05	0.18
I 1	SEARS	0.11	0.08	0.26
I 1	SEARS	0.06	0.01	0.27
B 2	THORN EMI			
B 2	THORN EMI			
B 2	THORN EMI	0.05	(0.06)	(0.06)
B 2	THORN EMI	0.05	(0.03)	(0.09)
B 2	THORN EMI	(0.11)	(0.15)	(0.24)
B 2	THORN EMI	0.06	0.01	(0.23)
B 2	THORN EMI	(0.03)	(0.08)	(0.31)
B 2	THORN EMI	(0.08)	(0.11)	(0.41)
B 2	THORN EMI	0.10	0.05	(0.36)
F 2	TRUSTHOUSE FORTE			
F 2	TRUSTHOUSE FORTE			
F 2	TRUSTHOUSE FORTE	0.16	0.04	0.04
F 2	TRUSTHOUSE FORTE	0.42	0.31	0.35
F 2	TRUSTHOUSE FORTE	0.10	0.05	0.40
F 2	TRUSTHOUSE FORTE	0.29	0.23	0.63
F 2	TRUSTHOUSE FORTE	0.12	0.06	0.69
F 2	TRUSTHOUSE FORTE	0.20	0.16	0.85
F 2	TRUSTHOUSE FORTE	0.44	0.38	1.23
H 3	UNILEVER			
H 3	UNILEVER	0.01	(0.14)	(0.14)
H 3	UNILEVER	0.19	0.06	(0.08)
H 3	UNILEVER	0.13	0.04	(0.04)
H 3	UNILEVER	0.07	0.02	(0.02)
H 3	UNILEVER	0.08	0.03	0.01

IND. CODE	COMPANY	% GROWTH IN EQUITY	EQUITY INDEX	CUM.GROWTH IN EQUITY
H 3	UNILEVER	(0.01)	(0.07)	(0.06)
H 3	UNILEVER	0.12	0.08	0.03
H 3	UNILEVER			

IND. CODE	COMPANY	% GROWTH IN SALES	SALES INDEX	CUM.GROWTH SALES
H 1	ALLIED-LYONS			
H 1	ALLIED-LYONS	0.10	(0.07)	(0.07)
H 1	ALLIED-LYONS	0.03	(0.08)	(0.14)
H 1	ALLIED-LYONS	0.06	(0.03)	(0.17)
H 1	ALLIED-LYONS	0.10	0.05	(0.12)
H 1	ALLIED-LYONS	0.08	0.03	(0.09)
H 1	ALLIED-LYONS	0.11	0.05	(0.04)
H 1	ALLIED-LYONS	0.04	0.01	(0.03)
H 1	ALLIED-LYONS	0.09	0.05	0.02
H 5	ASSD.BRIT FOODS			
H 5	ASSD.BRIT FOODS	0.13	(0.04)	(0.04)
H 5	ASSD.BRIT FOODS	0.20	0.07	0.03
H 5	ASSD.BRIT FOODS	0.15	0.06	0.09
H 5	ASSD.BRIT FOODS	0.13	0.08	0.18
H 5	ASSD.BRIT FOODS	(0.18)	(0.22)	(0.04)
H 5	ASSD.BRIT FOODS	0.06	(0.00)	(0.04)
H 5	ASSD.BRIT FOODS	0.07	0.03	(0.01)
H 5	ASSD.BRIT FOODS	(0.30)	(0.32)	(0.33)
H 1	BASS			
H 1	BASS	0.11	(0.05)	(0.05)
H 1	BASS	0.36	0.21	0.16
H 1	BASS	0.09	0.00	0.16
H 1	BASS	0.07	0.02	0.18
H 1	BASS	0.13	0.08	0.26
H 1	BASS	0.07	0.01	0.27
H 1	BASS	0.12	0.09	0.36
H 1	BASS	0.19	0.14	0.49
H 6	BAT INDS.			
H 6	BAT INDS.	0.06	(0.10)	(0.10)
H 6	BAT INDS.	0.21	0.08	(0.02)
H 6	BAT INDS.	0.22	0.13	0.11
H 6	BAT INDS.	0.03	(0.02)	0.09
H 6	BAT INDS.	0.22	0.16	0.25
H 6	BAT INDS.	(0.12)	(0.17)	0.08
H 6	BAT INDS.	0.09	0.05	0.14
H 6	BAT INDS.	0.26	0.21	0.35
D 7	BEECHAM GROUP			
D 7	BEECHAM GROUP	0.04	(0.12)	(0.12)
D 7	BEECHAM GROUP	0.16	0.04	(0.08)
D 7	BEECHAM GROUP	0.18	0.08	0.01
D 7	BEECHAM GROUP	0.21	0.16	0.16
D 7	BEECHAM GROUP	0.14	0.09	0.25
D 7	BEECHAM GROUP	0.18	0.11	0.36
D 7	BEECHAM GROUP	0.14	0.10	0.46
D 7	BEECHAM GROUP	0.05	0.01	0.47
A 5	BLUE CIRCLE IND			
A 5	BLUE CIRCLE IND	0.21	0.03	0.03
A 5	BLUE CIRCLE IND	0.18	0.05	0.08
A 5	BLUE CIRCLE IND	0.05	(0.04)	0.04
A 5	BLUE CIRCLE IND	0.15	0.10	0.15
A 5	BLUE CIRCLE IND	(0.04)	(0.09)	0.06

IND. CODE	COMPANY	% GROWTH IN SALES	SALES INDEX	CUM.GROWTH SALES
A 5	BLUE CIRCLE IND	0.09	0.03	0.09
A 5	BLUE CIRCLE IND	0.16	0.12	0.21
A 5	BLUE CIRCLE IND	(0.03)	(0.07)	0.14
G 6	BOOTS			
G 6	BOOTS	0.49	0.27	0.27
G 6	BOOTS	0.14	0.02	0.29
G 6	BOOTS	0.08	(0.00)	0.29
G 6	BOOTS	0.12	0.07	0.36
G 6	BOOTS	0.10	0.05	0.41
G 6	BOOTS	0.11	0.05	0.45
G 6	BOOTS	0.05	0.01	0.46
G 6	BOOTS	0.11	0.06	0.53
A 3	BPB INDUSTRIES			
A 3	BPB INDUSTRIES	0.43	0.21	0.21
A 3	BPB INDUSTRIES	0.06	(0.05)	0.16
A 3	BPB INDUSTRIES	0.12	0.04	0.19
A 3	BPB INDUSTRIES	0.15	0.10	0.29
A 3	BPB INDUSTRIES	0.16	0.10	0.40
A 3	BPB INDUSTRIES	0.04	(0.02)	0.38
A 3	BPB INDUSTRIES	0.09	0.06	0.44
A 3	BPB INDUSTRIES	0.22	0.17	0.61
D 8	BRIT. PETROLEUM			
D 8	BRIT. PETROLEUM	0.14	(0.03)	(0.03)
D 8	BRIT. PETROLEUM	0.18	0.06	0.03
D 8	BRIT. PETROLEUM	(0.04)	(0.12)	(0.09)
D 8	BRIT. PETROLEUM	0.29	0.24	0.15
D 8	BRIT. PETROLEUM	0.16	0.11	0.25
D 8	BRIT. PETROLEUM	0.07	0.01	0.26
D 8	BRIT. PETROLEUM	(0.27)	(0.30)	(0.04)
D 8	BRIT. PETROLEUM	0.02	(0.02)	(0.06)
E 9	COURTAULDS			
E 9	COURTAULDS	(0.22)	(0.34)	(0.34)
E 9	COURTAULDS	(0.06)	(0.16)	(0.50)
E 9	COURTAULDS	0.05	(0.04)	(0.53)
E 9	COURTAULDS	0.06	0.02	(0.52)
E 9	COURTAULDS	0.07	0.02	(0.50)
E 9	COURTAULDS	0.06	(0.00)	(0.50)
E 9	COURTAULDS	0.01	(0.02)	(0.53)
E 9	COURTAULDS	0.04	(0.00)	(0.53)
I 2	ENG. CHINA CLAYS			
I 2	ENG. CHINA CLAYS	0.18	0.00	0.00
I 2	ENG. CHINA CLAYS	0.04	(0.07)	(0.07)
I 2	ENG. CHINA CLAYS	0.17	0.07	0.01
I 2	ENG. CHINA CLAYS	0.22	0.17	0.17
I 2	ENG. CHINA CLAYS	0.23	0.17	0.35
I 2	ENG. CHINA CLAYS	0.18	0.11	0.46
I 2	ENG. CHINA CLAYS	(0.04)	(0.07)	0.39
I 2	ENG. CHINA CLAYS	0.11	0.06	0.46
D 7	GLAXO HLDGS			
D 7	GLAXO HLDGS	0.15	(0.03)	(0.03)
D 7	GLAXO HLDGS	0.15	0.03	0.00

IND. CODE	COMPANY	% GROWTH IN SALES	SALES INDEX	CUM.GROWTH SALES
D 7	GLAXO HLDGS	0.22	0.12	0.12
D 7	GLAXO HLDGS	0.19	0.13	0.26
D 7	GLAXO HLDGS	0.17	0.11	0.37
D 7	GLAXO HLDGS	0.18	0.11	0.48
D 7	GLAXO HLDGS	0.01	(0.02)	0.46
D 7	GLAXO HLDGS	0.22	0.17	0.63
B 1	HAWKER SIDDELEY			
B 1	HAWKER SIDDELEY	0.09	(0.08)	(0.08)
B 1	HAWKER SIDDELEY	0.16	0.03	(0.04)
B 1	HAWKER SIDDELEY	0.01	(0.07)	(0.11)
B 1	HAWKER SIDDELEY	0.04	(0.01)	(0.12)
B 1	HAWKER SIDDELEY	0.10	0.05	(0.08)
B 1	HAWKER SIDDELEY	(0.01)	(0.06)	(0.14)
B 1	HAWKER SIDDELEY	0.01	(0.02)	(0.16)
B 1	HAWKER SIDDELEY	0.08	0.04	(0.12)
A 3	PILKINGTON BROS			
A 3	PILKINGTON BROS	0.32	0.13	0.13
A 3	PILKINGTON BROS	0.25	0.12	0.24
A 3	PILKINGTON BROS	0.22	0.12	0.37
A 3	PILKINGTON BROS	0.07	0.02	0.38
A 3	PILKINGTON BROS	0.19	0.13	0.52
A 3	PILKINGTON BROS	0.01	(0.05)	0.47
A 3	PILKINGTON BROS	0.08	0.04	0.51
A 3	PILKINGTON BROS	0.59	0.53	1.04
B 2	RACAL ELECTRONIC			
B 2	RACAL ELECTRONIC	0.82	0.55	0.55
B 2	RACAL ELECTRONIC	1.04	0.82	1.37
B 2	RACAL ELECTRONIC	0.20	0.11	1.47
B 2	RACAL ELECTRONIC	0.18	0.13	1.61
B 2	RACAL ELECTRONIC	0.07	0.02	1.62
B 2	RACAL ELECTRONIC	0.36	0.28	1.90
B 2	RACAL ELECTRONIC	0.14	0.11	2.01
B 2	RACAL ELECTRONIC	0.02	(0.02)	1.99
H 5	RANK HOVIS			
H 5	RANK HOVIS	0.02	(0.13)	(0.13)
H 5	RANK HOVIS	0.26	0.13	(0.00)
H 5	RANK HOVIS	(0.13)	(0.20)	(0.20)
H 5	RANK HOVIS	0.02	(0.02)	(0.22)
H 5	RANK HOVIS	(0.25)	(0.28)	(0.51)
H 5	RANK HOVIS	0.07	0.01	(0.50)
H 5	RANK HOVIS	0.08	0.04	(0.46)
H 5	RANK HOVIS	0.09	0.05	(0.41)
D 7	RECKITT & COLMAN			
D 7	RECKITT & COLMAN	0.10	(0.06)	(0.06)
D 7	RECKITT & COLMAN	0.25	0.12	0.05
D 7	RECKITT & COLMAN	(0.01)	(0.09)	(0.03)
D 7	RECKITT & COLMAN	0.09	0.04	0.01
D 7	RECKITT & COLMAN	0.15	0.09	0.10
D 7	RECKITT & COLMAN	0.13	0.06	0.16
D 7	RECKITT & COLMAN	0.05	0.01	0.18
D 7	RECKITT & COLMAN	0.12	0.08	0.26

IND. CODE	COMPANY	% GROWTH IN SALES	SALES INDEX	CUM.GROWTH SALES
H 6	ROTHMANS INL B			
H 6	ROTHMANS INL B	(0.09)	(0.22)	(0.22)
H 6	ROTHMANS INL B	0.00	(0.11)	(0.33)
H 6	ROTHMANS INL B	0.12	0.03	(0.30)
H 6	ROTHMANS INL B	(0.47)	(0.49)	(0.79)
H 6	ROTHMANS INL B	1.51	1.39	0.59
H 6	ROTHMANS INL B	(0.56)	(0.59)	0.01
H 6	ROTHMANS INL B	(0.09)	(0.12)	(0.11)
H 6	ROTHMANS INL B	0.02	(0.02)	(0.13)
H 4	ROWN TREE			
H 4	ROWN TREE	0.05	(0.11)	(0.11)
H 4	ROWN TREE	0.09	(0.02)	(0.13)
H 4	ROWN TREE	0.12	0.03	(0.10)
H 4	ROWN TREE	0.24	0.18	0.08
H 4	ROWN TREE	0.21	0.16	0.24
H 4	ROWN TREE	0.04	(0.02)	0.22
H 4	ROWN TREE	0.07	0.04	0.25
H 4	ROWN TREE	0.11	0.06	0.32
I 1	SEARS			
I 1	SEARS	0.42	0.21	0.21
I 1	SEARS	0.10	(0.02)	0.19
I 1	SEARS	0.08	(0.01)	0.18
I 1	SEARS	0.07	0.02	0.21
I 1	SEARS	0.16	0.10	0.31
I 1	SEARS	0.09	0.03	0.34
I 1	SEARS	0.13	0.09	0.43
I 1	SEARS	0.09	0.05	0.48
B 2	THORN EMI			
B 2	THORN EMI	0.44	0.22	0.22
B 2	THORN EMI	0.38	0.23	0.45
B 2	THORN EMI	0.09	0.01	0.46
B 2	THORN EMI	0.11	0.07	0.52
B 2	THORN EMI	0.04	(0.01)	0.51
B 2	THORN EMI	0.14	0.07	0.58
B 2	THORN EMI	0.03	0.00	0.59
B 2	THORN EMI	(0.04)	(0.08)	0.51
F 2	TRUSTHOUSE FORTE			
F 2	TRUSTHOUSE FORTE	0.08	(0.08)	(0.08)
F 2	TRUSTHOUSE FORTE	0.08	(0.04)	(0.11)
F 2	TRUSTHOUSE FORTE	0.09	0.00	(0.11)
F 2	TRUSTHOUSE FORTE	0.06	0.02	(0.10)
F 2	TRUSTHOUSE FORTE	0.17	0.12	0.02
F 2	TRUSTHOUSE FORTE	0.10	0.04	0.06
F 2	TRUSTHOUSE FORTE	0.19	0.15	0.21
F 2	TRUSTHOUSE FORTE	0.20	0.16	0.36
H 3	UNILEVER			
H 3	UNILEVER	(0.01)	(0.16)	(0.16)
H 3	UNILEVER	0.17	0.05	(0.11)
H 3	UNILEVER	0.11	0.02	(0.09)
H 3	UNILEVER	0.01	(0.03)	(0.12)
H 3	UNILEVER	0.21	0.15	0.03

IND. CODE	COMPANY	% GROWTH IN SALES	SALES INDEX	CUM.GROWTH SALES
H 3	UNILEVER	0.03	(0.03)	0.00
H 3	UNILEVER	0.03	(0.01)	(0.00)
H 3	UNILEVER	(0.03)	(0.07)	(0.08)

IND. CODE		COMPANY	TOTAL ANNUAL INVESTORS RETURN	EQUITY INDEX	SALES INDEX (m)
H	1	ALLIED-LYONS			2,353
H	1	ALLIED-LYONS	(0.08)	885	2,200
H	1	ALLIED-LYONS	0.13	793	2,027
H	1	ALLIED-LYONS	0.99	767	1,974
H	1	ALLIED-LYONS	0.06	770	2,080
H	1	ALLIED-LYONS	0.22	907	2,137
H	1	ALLIED-LYONS	0.70	920	2,244
H	1	ALLIED-LYONS	0.24	1,270	2,257
H	1	ALLIED-LYONS	0.10	1,114	2,372
H	5	ASSD.BRIT FOODS			2,235
H	5	ASSD.BRIT FOODS	0.49	409	2,146
H	5	ASSD.BRIT FOODS	0.16	412	2,300
H	5	ASSD.BRIT FOODS	0.14	447	2,444
H	5	ASSD.BRIT FOODS	0.02	494	2,648
H	5	ASSD.BRIT FOODS	0.47	589	2,072
H	5	ASSD.BRIT FOODS	0.30	594	2,071
H	5	ASSD.BRIT FOODS	0.22	627	2,139
H	5	ASSD.BRIT FOODS	(0.02)	969	1,445
H	1	BASS		705	1,334
H	1	BASS	0.13	864	1,263
H	1	BASS	0.04	914	1,531
H	1	BASS	0.50	894	1,532
H	1	BASS	0.06	908	1,564
H	1	BASS	0.61	937	1,688
H	1	BASS	0.39	975	1,704
H	1	BASS	0.14	988	1,852
H	1	BASS	0.15	1,599	2,109
H	6	BAT INDS.		1,976	8,504
H	6	BAT INDS.	0.10	1,746	7,645
H	6	BAT INDS.	0.56	1,982	8,280
H	6	BAT INDS.	0.84	2,240	9,315
H	6	BAT INDS.	0.19	2,493	9,168
H	6	BAT INDS.	1.02	3,205	10,661
H	6	BAT INDS.	(0.07)	2,595	8,852
H	6	BAT INDS.	0.51	2,849	9,312
H	6	BAT INDS.	(0.01)		11,291
D	7	BEECHAM GROUP		612	1,165
D	7	BEECHAM GROUP	0.59	558	1,028
D	7	BEECHAM GROUP	0.26	619	1,068
D	7	BEECHAM GROUP	0.58		1,158
D	7	BEECHAM GROUP	(0.06)	587	1,339
D	7	BEECHAM GROUP	0.31	738	1,457
D	7	BEECHAM GROUP	(0.05)	834	1,618
D	7	BEECHAM GROUP	0.25	809	1,779
D	7	BEECHAM GROUP	0.03	836	1,791
A	5	BLUE CIRCLE IND		747	621
A	5	BLUE CIRCLE IND	0.50	744	637
A	5	BLUE CIRCLE IND	0.52	748	670
A	5	BLUE CIRCLE IND	(0.11)	704	646
A	5	BLUE CIRCLE IND	0.03	746	713
A	5	BLUE CIRCLE IND	0.18	754	652

IND. CODE	COMPANY	TOTAL INVESTORS ANNUAL RETURN	EQUITY INDEX	SALES INDEX (m)
A 5	BLUE CIRCLE IND	0.24	679	670
A 5	BLUE CIRCLE IND	0.21	608	751
A 5	BLUE CIRCLE IND	0.33		701
G 6	BOOTS			947
G 6	BOOTS	0.53	474	1,202
G 6	BOOTS	(0.15)	467	1,228
G 6	BOOTS	0.32	483	1,224
G 6	BOOTS	0.47	500	1,314
G 6	BOOTS	0.13	515	1,374
G 6	BOOTS	0.36	545	1,437
G 6	BOOTS	(0.10)	566	1,453
G 6	BOOTS	0.19	599	1,543
A 3	BPB INDUSTRIES			281
A 3	BPB INDUSTRIES	0.48	151	341
A 3	BPB INDUSTRIES	0.52	158	323
A 3	BPB INDUSTRIES	0.66	166	334
A 3	BPB INDUSTRIES	0.06	196	367
A 3	BPB INDUSTRIES	0.04	201	405
A 3	BPB INDUSTRIES	0.31	213	399
A 3	BPB INDUSTRIES	0.51	232	421
A 3	BPB INDUSTRIES	0.02	262	492
D 8	BRIT. PETROLEUM		5,875	26,713
D 8	BRIT. PETROLEUM	0.27	5,925	25,848
D 8	BRIT. PETROLEUM	(0.17)	6,903	27,367
D 8	BRIT. PETROLEUM	0.00	5,332	24,145
D 8	BRIT. PETROLEUM	0.45	7,583	29,866
D 8	BRIT. PETROLEUM	0.27	8,653	33,028
D 8	BRIT. PETROLEUM	0.22	7,002	33,326
D 8	BRIT. PETROLEUM	0.37	6,808	23,409
D 8	BRIT. PETROLEUM	0.09	7,053	22,921
E 9	COURTAULDS			2,752
E 9	COURTAULDS	(0.10)	449	1,819
E 9	COURTAULDS	0.36	292	1,528
E 9	COURTAULDS	0.03	283	1,473
E 9	COURTAULDS	0.78	272	1,500
E 9	COURTAULDS	0.07	347	1,528
E 9	COURTAULDS	0.54	367	1,521
E 9	COURTAULDS	0.63	386	1,485
E 9	COURTAULDS	0.12	431	1,484
I 2	ENG. CHINA CLAYS			331
I 2	ENG. CHINA CLAYS	0.24	218	332
I 2	ENG. CHINA CLAYS	0.80	215	308
I 2	ENG. CHINA CLAYS	0.13	226	331
I 2	ENG. CHINA CLAYS	0.30	274	386
I 2	ENG. CHINA CLAYS	0.30	273	453
I 2	ENG. CHINA CLAYS	0.16	318	505
I 2	ENG. CHINA CLAYS	0.14	323	471
I 2	ENG. CHINA CLAYS	0.30	326	500
D 7	GLAXO HLDGS		265	634
D 7	GLAXO HLDGS	0.29	338	618
D 7	GLAXO HLDGS	0.61	341	634

IND. CODE	COMPANY	TOTAL ANNUAL INVESTORS RETURN	EQUITY INDEX	SALES INDEX (m)
D 7	GLAXO HLDGS	1.99	360	713
D 7	GLAXO HLDGS	0.13	433	808
D 7	GLAXO HLDGS	0.59	512	899
D 7	GLAXO HLDGS	0.42	607	998
D 7	GLAXO HLDGS	0.38	748	977
D 7	GLAXO HLDGS	(0.04)	953	1,142
B 1	HAWKER SIDDELEY		549	1,306
B 1	HAWKER SIDDELEY	0.47	502	1,205
B 1	HAWKER SIDDELEY	0.31	517	1,247
B 1	HAWKER SIDDELEY	0.06	525	1,158
B 1	HAWKER SIDDELEY	0.09	611	1,146
B 1	HAWKER SIDDELEY	0.25	652	1,199
B 1	HAWKER SIDDELEY	0.11	576	1,125
B 1	HAWKER SIDDELEY	(0.00)	519	1,099
B 1	HAWKER SIDDELEY	0.04		1,144
A 3	PILKINGTON BROS		685	559
A 3	PILKINGTON BROS	0.38	736	629
A 3	PILKINGTON BROS	0.03	690	703
A 3	PILKINGTON BROS	(0.38)	713	789
A 3	PILKINGTON BROS	0.51	720	804
A 3	PILKINGTON BROS	0.46	709	910
A 3	PILKINGTON BROS	0.12	767	867
A 3	PILKINGTON BROS	1.08	712	903
A 3	PILKINGTON BROS	0.04	585	1,380
B 2	RACAL ELECTRONIC		151	170
B 2	RACAL ELECTRONIC	0.84	212	263
B 2	RACAL ELECTRONIC	0.33	237	479
B 2	RACAL ELECTRONIC	0.38	256	530
B 2	RACAL ELECTRONIC	(0.28)	245	600
B 2	RACAL ELECTRONIC	0.25	276	611
B 2	RACAL ELECTRONIC	(0.38)	308	782
B 2	RACAL ELECTRONIC	0.23	296	866
B 2	RACAL ELECTRONIC	0.16	295	847
H 5	RANK HOVIS			1,673
H 5	RANK HOVIS	0.11	295	1,456
H 5	RANK HOVIS	0.49	284	1,638
H 5	RANK HOVIS	(0.05)	276	1,315
H 5	RANK HOVIS	0.53	251	1,288
H 5	RANK HOVIS	0.85	232	922
H 5	RANK HOVIS	0.28	229	928
H 5	RANK HOVIS	0.69	241	967
H 5	RANK HOVIS	0.20	164	1,013
D 7	RECKITT & COLMAN		231	775
D 7	RECKITT & COLMAN	0.03	201	728
D 7	RECKITT & COLMAN	0.40		812
D 7	RECKITT & COLMAN	0.55	200	742
D 7	RECKITT & COLMAN	0.21	218	772
D 7	RECKITT & COLMAN	0.36	309	843
D 7	RECKITT & COLMAN	0.17	269	895
D 7	RECKITT & COLMAN	0.36	290	909
D 7	RECKITT & COLMAN	(0.06)		980

IND. CODE	COMPANY	TOTAL ANNUAL INVESTORS RETURN	EQUITY INDEX	SALES INDEX (m)
H 6	ROTHMANS INL B		320	3,186
H 6	ROTHMANS INL B	(0.02)	155	2,475
H 6	ROTHMANS INL B	0.85	208	2,212
H 6	ROTHMANS INL B	0.59	253	2,277
H 6	ROTHMANS INL B	0.07	347	1,152
H 6	ROTHMANS INL B	0.59	417	2,752
H 6	ROTHMANS INL B	(0.23)	325	1,134
H 6	ROTHMANS INL B	0.40	297	1,003
H 6	ROTHMANS INL B	1.14	335	981
H 4	ROWN TREE		266	707
H 4	ROWN TREE	0.01	243	630
H 4	ROWN TREE	0.16	286	615
H 4	ROWN TREE	0.28	284	634
H 4	ROWN TREE	0.11	272	749
H 4	ROWN TREE	0.82	292	867
H 4	ROWN TREE	0.10	263	852
H 4	ROWN TREE	0.04	266	882
H 4	ROWN TREE	0.15	266	937
I 1	SEARS			1,040
I 1	SEARS	0.47	519	1,258
I 1	SEARS	0.02	486	1,237
I 1	SEARS	0.91	461	1,227
I 1	SEARS	0.23	558	1,256
I 1	SEARS	0.15	580	1,384
I 1	SEARS	0.23	606	1,427
I 1	SEARS	0.15	652	1,557
I 1	SEARS	0.09	662	1,627
B 2	THORN EMI			1,326
B 2	THORN EMI	0.24	548	1,621
B 2	THORN EMI	0.47	516	1,992
B 2	THORN EMI	(0.02)	500	2,005
B 2	THORN EMI	0.55	425	2,137
B 2	THORN EMI	(0.22)	431	2,115
B 2	THORN EMI	(0.14)	395	2,265
B 2	THORN EMI	0.21	353	2,267
B 2	THORN EMI	0.18	371	2,090
F 2	TRUSTHOUSE FORTE			838
F 2	TRUSTHOUSE FORTE	0.51	347	772
F 2	TRUSTHOUSE FORTE	(0.01)	360	744
F 2	TRUSTHOUSE FORTE	0.40	472	746
F 2	TRUSTHOUSE FORTE	0.22	496	758
F 2	TRUSTHOUSE FORTE	0.61	610	848
F 2	TRUSTHOUSE FORTE	0.11	647	880
F 2	TRUSTHOUSE FORTE	0.18	752	1,009
F 2	TRUSTHOUSE FORTE	0.25	1,037	1,167
H 3	UNILEVER		2,522	12,058
H 3	UNILEVER	0.06	2,160	10,152
H 3	UNILEVER	0.39	2,296	10,625
H 3	UNILEVER	0.31	2,388	10,877
H 3	UNILEVER	0.20	2,436	10,532
H 3	UNILEVER	0.26	2,510	12,123

IND. CODE	COMPANY	TOTAL ANNUAL INVESTORS RETURN	EQUITY INDEX	SALES INDEX (m)
H 3	UNILEVER	0.29	2,343	11,797
H 3	UNILEVER	0.61	2,538	11,716
H 3	UNILEVER	0.09		10,860

IND. CODE	COMPANY	RETAIL PRICE INDEX	YEAR
H 1	ALLIED-LYONS	0.85	1979
H 1	ALLIED-LYONS	1.00	1980
H 1	ALLIED-LYONS	1.12	1981
H 1	ALLIED-LYONS	1.22	1982
H 1	ALLIED-LYONS	1.27	1983
H 1	ALLIED-LYONS	1.33	1984
H 1	ALLIED-LYONS	1.42	1985
H 1	ALLIED-LYONS	1.46	1986
H 1	ALLIED-LYONS	1.52	1987
H 5	ASSD.BRIT FOODS		
H 5	ASSD.BRIT FOODS		
H 5	ASSD.BRIT FOODS		
H 5	ASSD.BRIT FOODS		
H 5	ASSD.BRIT FOODS		
H 5	ASSD.BRIT FOODS		
H 5	ASSD.BRIT FOODS		
H 5	ASSD.BRIT FOODS		
H 5	ASSD.BRIT FOODS		
H 1	BASS		
H 1	BASS		
H 1	BASS		
H 1	BASS		
H 1	BASS		
H 1	BASS		
H 1	BASS		
H 1	BASS		
H 1	BASS		
H 6	BAT INDS.		
H 6	BAT INDS.		
H 6	BAT INDS.		
H 6	BAT INDS.		
H 6	BAT INDS.		
H 6	BAT INDS.		
H 6	BAT INDS.		
H 6	BAT INDS.		
H 6	BAT INDS.		
D 7	BEECHAM GROUP		
D 7	BEECHAM GROUP		
D 7	BEECHAM GROUP		
D 7	BEECHAM GROUP		
D 7	BEECHAM GROUP		
D 7	BEECHAM GROUP		
D 7	BEECHAM GROUP		
D 7	BEECHAM GROUP		
D 7	BEECHAM GROUP		
A 5	BLUE CIRCLE IND		
A 5	BLUE CIRCLE IND		
A 5	BLUE CIRCLE IND		
A 5	BLUE CIRCLE IND		
A 5	BLUE CIRCLE IND		
A 5	BLUE CIRCLE IND		